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## SCIENCE

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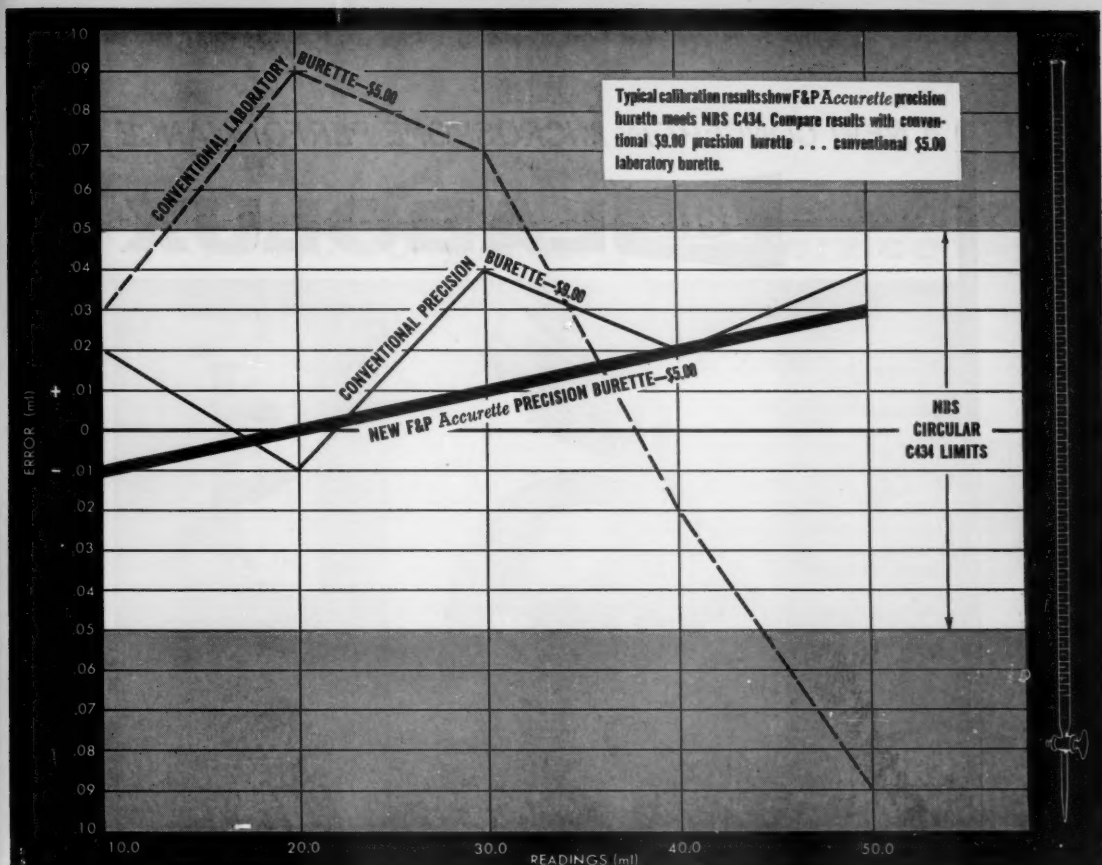
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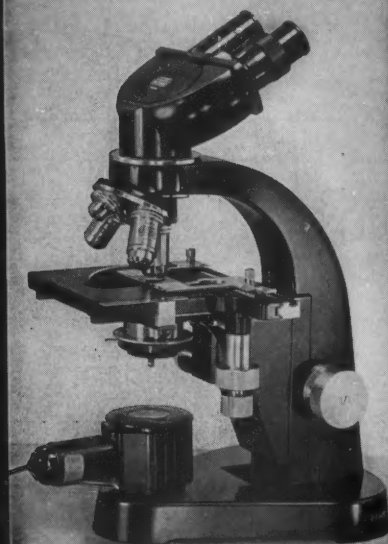
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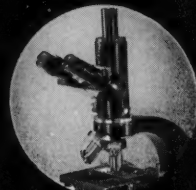
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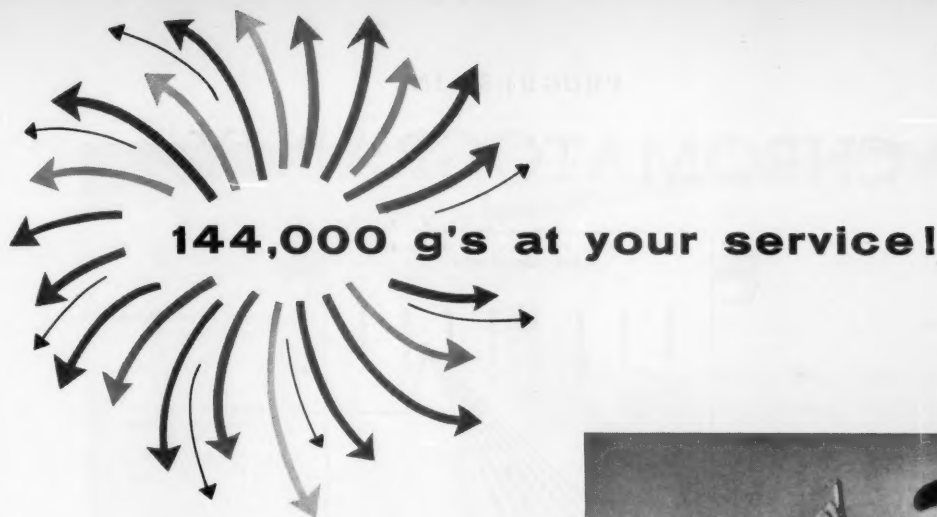
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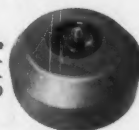
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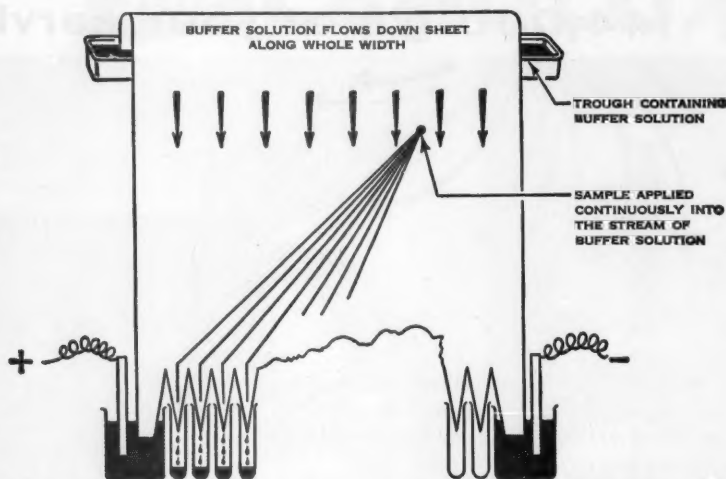
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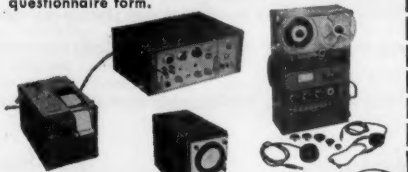
**SANBORN "150" SERIES RECORDERS**  
Inkless, Direct Writing, in True Rectangular Coordinates  
All provide choice of 9 paper travel speeds, automatic timing signal, manual or remote coding

**Choice of Pre-amplifiers provides system flexibility for changing requirements**

**NEW CATALOG OF  
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the right recording equipment  
for biophysical research ...**

The new catalog provides complete data on: 2-, 4-, 6- and 8-channel "150" Recording Systems and the five primary plug-in Pre-amplifiers used with them; four different single-channel recording systems, as well as the 2-channel Twin-Viso (direct writing) and Twin-Beam (photographic) systems; the Viso-Scope oscilloscope, its companion "OR" model for operating room use, and the related Vector Amplifier and Electronic Switch; the Amplifying Stethoscope, Heart Sound Tape Recorder/Player, and two series of physiological Pressure Transducers. Prices of all instruments are also included, as well as a useful equipment selection questionnaire form.



Recording System,  
Oscilloscope and Tape Recorder/Player...  
three of 17 instruments in Catalog



For the medical researcher or teacher concerned with measurement, recording and study of physiological phenomena such as pressures, temperatures, ECG's, sphygmograms, pneumograms, etc., valuable data is available in a new catalog describing the major Sanborn biophysical research instruments. Information about recording systems, monitoring oscilloscopes and transducers is presented from the standpoint of the user's requirements, rather than simply as product descriptions. By frequent use of typical examples — involving the number and nature of phenomena to be studied, the transducers or other associated equipment to be used, future needs vs. present requirements, etc. — the Sanborn catalog can greatly simplify equipment selection and insure maximum usefulness per dollar invested.

For your copy of this new Sanborn Catalog,  
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**SANBORN COMPANY**  
175 Wyman Street, Waltham 54, Massachusetts



## POLARIMETER with scale reading to $0.05^\circ$

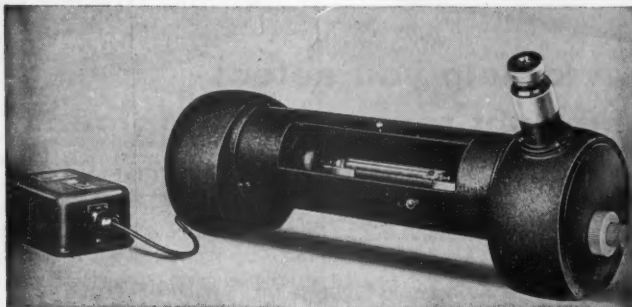
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- \* Inclined observation telescope permits readings from sitting position.
- \* Glass scale, verniers and Laurent half-shade plate (triple field of view) are observed in the same telescope.
- \* Illumination by either a double filament 40-watt bulb or sodium spectral bulb.
- \* Newly designed, precision polarimeter tubes ensure absence of strain, resulting in true measurements.
- \* Direct vernier readings can be made to  $0.05^\circ$  and estimated to  $0.025^\circ$ .



## POLARIMETER with scale reading to $0.01^\circ$

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Assures ease in manipulation and higher accuracy in making measurements because:

- \* Inclined observation telescope permits readings from sitting position.
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- \* Direct vernier readings can be made to  $0.01^\circ$  and estimated to  $0.005^\circ$ .
- \* Moveable carrier holding two polarimeter tubes facilitates procedure of examinations.
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## Kodak reports on:

photographic materials for looking down . . . ideas that gel, or turn thixotropic . . . a photographic plate within the spirit, if not the letter, of Lambert's Law

### A new aerial film

In an economy based squarely and frankly on planned technological obsolescence, it has been almost embarrassing that for many years the aerial mappers' Kodak Super-XX Aerographic Film has stayed virtually unchanged. When a company makes a product on which a whole craft bases itself, strong pressures are felt from the customers themselves to leave well enough alone. Eventually, though, comes time to uncork the achievements of research and see what happens.

So: In an airplane we identically mount two identical simultaneously actuated cameras with identical lenses and take them up to 20,000 feet on a good day. One contains Kodak Super-XX Film and the other the new Kodak Plus-X Aerecon Film. We do some photography, give both films the same processing in Kodak Developer D-19, and put a magnifier to the negatives. Railroad ties are not resolved on the Super-XX, and they are resolved on the Plus-X Aerecon.

Plus-X Aerecon is designed for high-altitude work. It is about a third of a stop slower than Super-XX. Its spectral sensitivity goes out to 710 m $\mu$  in the near-infrared. Its acutance—a measure of the sharpness with which it can reproduce the edge of an object—is very much higher than that of Super-XX. Furthermore, its acutance remains high at the high densities. On a resolving power test object of 1000:1 contrast, Plus-X gives an advantage over Super-XX in the ratio of 9:8, but when the contrast drops to 2:1 the resolving power advantage of Plus-X, instead of vanishing, rises to 3:2. Our research men find this astonishing.

*They will be glad to talk with you and load you up with reprints of papers that distinguish in extremely precise language between resolving power, acutance, granularity, and graininess, which are all very different concepts. To dig into this thing, write Eastman Kodak Company, Government Sales Division, Rochester 4, N. Y.*

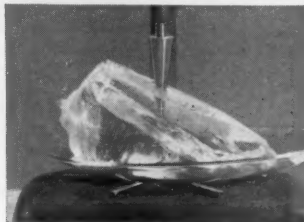
### Mono-and-water

We have run into a few matters in

the field of colloid chemistry that can stand being presented straight. They concern monoglycerides, a kind of fat widely used in baking. Monoglycerides which have been substantially freed of diglycerides by molecular distillation can seize water and imprison it.

•When a monoglyceride at a temperature above its melting point—which for some may not much exceed that of water—is poured into water at the same temperature, a firm gel is instantly formed. The gel contains 15 to 25% of water. Child of what appears to be hydrogen bonding of water to oil, it is dispersible in the former not at all and soluble in the latter only with difficulty. As long as kept warmer than the melting point of the monoglyceride and protected from drying, the gel is indefinitely stable.

•When the pouring is done the other way—water into the liquid monoglyceride—viscosity of the equilibrated system rises continuously until a non-pourable trans-



parent "solid" as firm as putty results.

•Clear homogeneous liquids can be made from water, plain fat, and monoglyceride. The water can carry water-soluble substances while the fat carries oil-soluble substances.

•With liquid monoglyceride, water, and soap, one can make a translucent thixotropic liquid that is "springy," like egg white. When cooled below a certain point, it changes to a crystalline character in which it is like translucent pudding, but still thixotropic. A word like "thixotropy," casually dropped in non-rheological company, can help a person.

*Notice how nothing is said about applications? That's because we do not want to prejudice your imagination, gen-*

*tle reader. For a full report on mono-and-water, as we see it to date, write Distillation Products Industries, Rochester 3, N. Y. (Division of Eastman Kodak Company). That's the same organization which puts out those Eastman Organic Chemicals which have been used in laboratories since Hector was a pup.*

### In memory of a perfectionist

As Johann H. Lambert must have remarked more than once before he passed away in 1777, wenn die Lichtstärke der von einer Fläche kommenden Strahlung dem Cosinus des Winkels zwischen Strahlrichtung und Flächennormalen proportional ist, so nennen wir die Fläche eine vollkommen streuende Fläche. In short, a perfect diffuser has the same brightness from every direction. A nearly perfectly diffuse reflector is fairly easy to come by, but a perfectly diffuse transmitter is just a convenient idea, remote from reality.

We like to think that a product we call Kodak Day View Screens, though far from the letter of Lambert's Law, comes as close to diffuse transmission as any material available. We make these for optical instruments wherein an image is to be projected from behind the screen with a minimum of "hot spot" at the center to dazzle and annoy. They are clear glass plates precisely coated with one of several compositions that we are rather proud of.

Perhaps the thought occurs to you that a photographic emulsion might be coated over the light-diffusing composition, of a speed such that the plate might be exposed in a camera in order to get some sort of photographic pattern for comparison with a projected image on the screen. The very same thought has occurred to us.

As a result, we now offer Kodak Translucent Plates, Type 5. Axially the processed plates transmit 85% of the incident light (where unobscured by the photographic image, of course). At 0° they are only eight times brighter than Herr Lambert figured they ought to be, while at 30° they are 0.8 times as bright as he would have wanted. This is much better than it sounds and a whale of a lot better than ground glass. For more technical details and all the commercial details, write Eastman Kodak Company, Special Sensitized Products Division, Rochester 4, N. Y.

This is another advertisement where Eastman Kodak Company probes at random for mutual interests and occasionally a little revenue from those whose work has something to do with science

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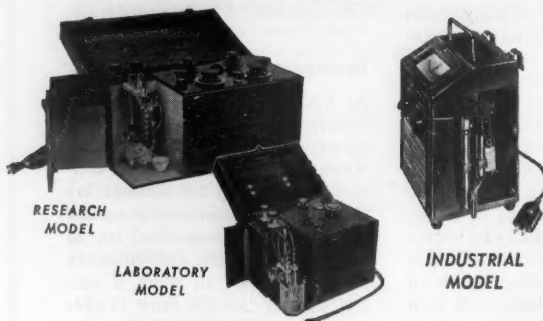
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**Industrial Model** is a direct-reading pH Meter for all-around plant and laboratory use. So simple even unskilled production workers can make accurate pH determinations with it. Accuracy 0.1 pH, range 0 to 14 pH.

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**Research Model:** Accuracy .02 pH, sensitivity .005 pH. Readings reproducible to .01 pH. Range 0 to 14 pH; 0 to 1200 mv.

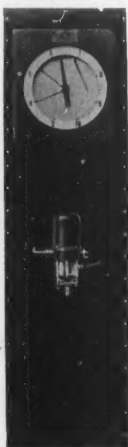
## pH RECORDERS AND INDICATOR-CONTROLLERS

Cambridge Single- or Multi-Point Electronic pH Recorders (at right) incorporate developments that make possible high accuracy, stability and trouble-free performance. Cambridge pH Indicator-Controllers (below) are used in chemical processes, waste disposal operations, etc., where an inexpensive means of measuring and controlling pH is a factor. Universal Type Electrode Assemblies are provided for either immersion or flow applications. These assemblies can be mounted at sampling points at any distance from the instrument.



Single-Point  
pH Recorder  
(Strip chart assemblies also available)

pH Indicator-  
Controller

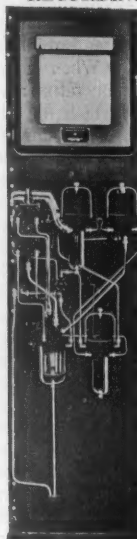


## CAMBRIDGE MOISTURE INDICATORS

Used in industries processing paper, textiles and other hygroscopic materials. In the surface model a reading of the moisture is obtained merely by placing the instrument on the material under test. The printer's model is provided with a blade 18" long containing the sensitive element for insertion in stacked or bulk materials.

1152

## CAMBRIDGE GAS ANALYZERS RECORDING ANALYZERS—Single- and Multi-Point



3-Point Recording  
Gas Analyzers  
(CO<sub>2</sub>, H<sub>2</sub>, CO)

Cambridge Gas Analyzers continuously analyze and simultaneously record on one chart from one to six constituents of a gas. They may be used for most simple and many complex mixtures of gases. Dependable and labor-saving these Analyzers make possible increased efficiency and savings in the operation of steam generating plants, cement kilns, blast furnaces; in the production of inert gases; in metallurgy, in petroleum refining and other chemical processes.

Employing the thermal conductivity principle, no chemicals, fragile glassware, or moving parts are used in analysis units. Completely automatic; only minimum attention is needed. Accurate and sensitive, ruggedly built to stand up under plant conditions. Operate from electric supply line. Multi-Point Analyzers can be connected to different sampling points and used with one recorder which is located wherever desired.

**COMBINATION GAS ANALYZERS: A 5-Point Gas Analyzer** provides simultaneous analysis and continuous graphic record of the CO<sub>2</sub>, H<sub>2</sub>, CO, CH<sub>4</sub>, and O<sub>2</sub> in a sample of combustion products, or of five constituents of other gases. Other models are available in standard units including a **3-Point Gas Analyzer** (see illustration at left) for CO<sub>2</sub>, H<sub>2</sub>, and CO; **2-Point Analyzer** for Dissolved O<sub>2</sub> and Dissolved H<sub>2</sub> or for O<sub>2</sub> and CO<sub>2</sub> etc.

**SINGLE-POINT ANALYZERS: Dissolved O<sub>2</sub> Recorder** furnishes continuous check on oxygen in boiler feed water and in the aeration and final tanks of sewage treatment plants.

**Dissolved H<sub>2</sub> Recorder** continuously determines and records hydrogen concentration in steam condensate.

**O<sub>2</sub> Recorder** measures and records the amount of oxygen in flue gases, etc., etc.

*Descriptive literature on any Cambridge Gas Analyzer will be mailed on request. We invite your inquiry on any special gas analysis problem you may have; send details for our recommendation.*

## PORTABLE INDICATING ANALYZERS

For fast and accurate testing, Cambridge Portable Gas Analyzers are available for a number of gases such as CO<sub>2</sub>, H<sub>2</sub>, He, A, automotive exhaust gas. **Write for literature, and please send details of your application.**



Indicating  
CO<sub>2</sub> Analyzer  
Weight 12 lbs.  
7" x 8 1/2" x 11"

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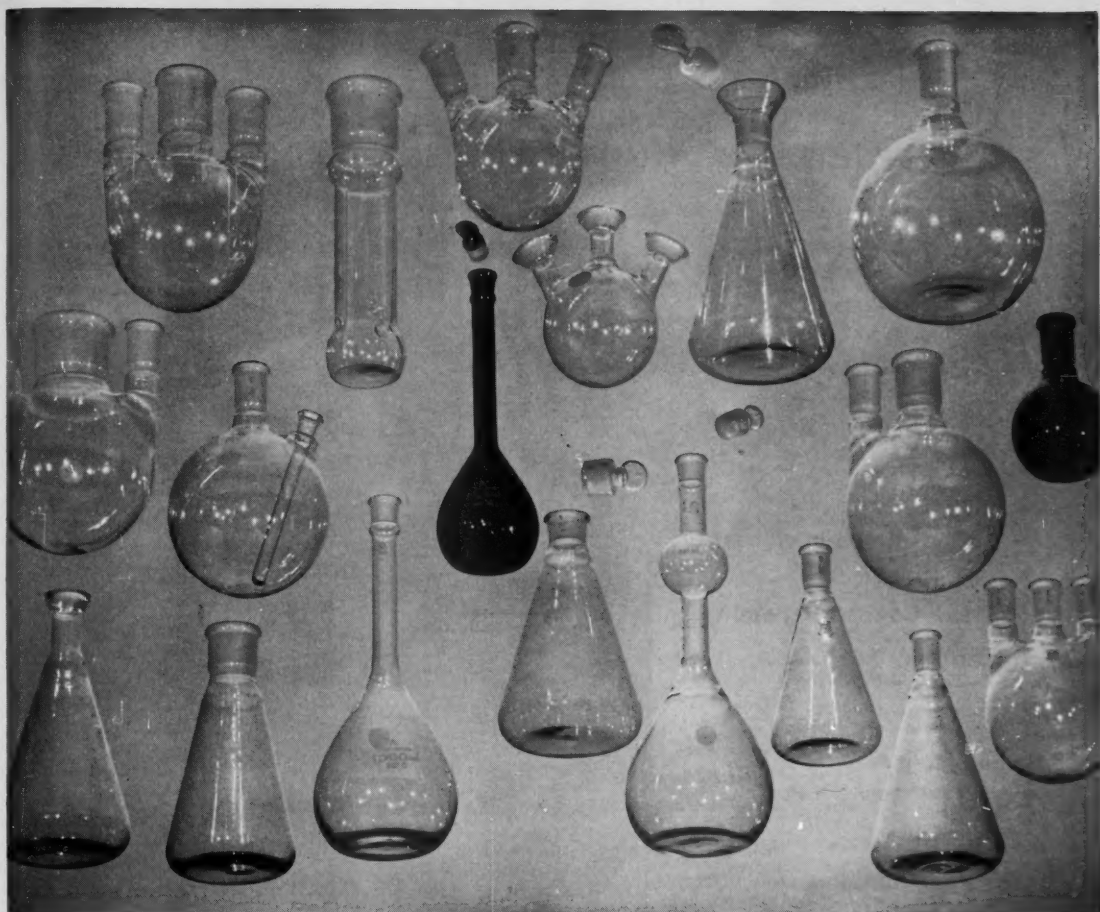


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**HYDRAZINE RECORDER**, for continuous measurement and control of NaH in boiler feedwater and other aqueous solutions. Ranges: 0-200 and 0-160 ppb of NaH.

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If you would like to look at the assortment of these long-lasting, superlatively made flasks, you'll find them listed in our new catalogs, LP36 for standard laboratory ware and CA-2 our special glassware catalog.



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**FOR CONDUCTOMETRIC TITRATIONS**

- No Electrodes
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- High Sensitivity



**MODEL HF**

Designed and manufactured by  
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with Fred W. Jensen.

## **S-29230 TITRATOR—Sargent-Jensen, Model HF.**

This instrument provides a new facility for the high frequency measurement of conductance and dielectric constant. It is primarily designed for use with aqueous or semi-aqueous solutions of electrolytes, and in particular as an indicator of the course of titration reactions for end point determination. This method is characterized by an absence of physical or electrical contact between instrument and the solution under measurement, and thereby eliminates the problems associated with use of electrodes in low frequency conductance measurement, while providing a high order of sensitivity.

The method is based upon the principle that changes in the electrical properties of a solution exposed to the high frequency electromagnetic or electrostatic field associated with an electronic oscillator are reflected as changes in the electrical character of the oscillator circuit. The instrument measures directly the high frequency voltage appearing at a circuit tuned by the sample and its associated vessel to a frequency of 4.5 megacycles per second.

Changes in conductance result in changes in the amount of power withdrawn from the circuit with consequent changes in amplitude of the high frequency voltage. Changes in conductance in a sample solution during titration are, therefore, registered as deflection of a panel mounted meter. The course of a titration may be followed by recording meter deflection as a function of volume of titrant added.

All controls necessary for operation of the instrument are mounted on a sloping front panel of aluminum with an anodized finish. In addition to the large indicating meter mounted at the center of the panel there are grouped controls for adjusting the sensitivity of indication, for compensation of a major part of the initial voltage to allow use of maximum sensitivity during titration, and a tuning adjustment whereby increased sensitivity may be provided in titrations involving very dilute solutions. Height, 8½ inches; width, 17¾ inches; depth, 11 inches; finish, gray enamel. Complete with one S-29240 cell and cord and plug for attachment to standard outlets. For operation from 115 volt, 60 cycle, A.C. circuits.....**\$425.00**

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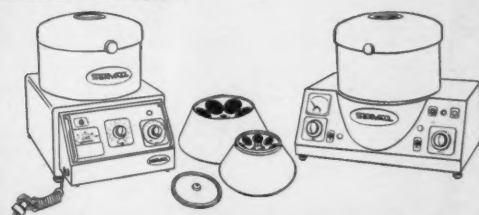
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**SERVALL ENCLOSED CENTRIFUGE**      **SERVALL AUTOMATIC CENTRIFUGE**

**SERVALL SS-4 ENCLOSED SUPERSPEED CENTRIFUGE** has same rotor versatility as SS-3 and same Gyro-Action Drive, but is manually controlled.

Both the SS-3 and SS-4 have the unique SERVALL Noise-Suppression and Dual Cooling Systems, Safety Interlock to break circuit should rotor-imbalance occur, Direct-Reading Tachometer—Ammeter, Timer, Remote-Control facility, and Low Silhouette for convenient accessibility.

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## New Things in Three Dimensions

Large-scale exhibits have been an integral and important feature of AAAS meetings since 1924. In accord with the diversity of the Association's conventions, with all principal fields of science represented by the programs of the sections and the participating societies, the exhibits are both numerous and varied. Each of the major fields of science is sufficiently represented at the meetings to warrant the participation of exhibitors with lines of particular interest. Thus, for example, some exhibits will appeal especially to astronomers, geologists, physicists, biologists, or medical researchers, but will not be without interest to those in other disciplines. In recent years, the publishers, instrument makers, and larger supply houses have been joined by such agencies as *Biological Abstracts*, the Educational Testing Service, the National Science Foundation, and the Oak Ridge Institute of Nuclear Studies, as well as a growing number of large industries showing highly informative institutional exhibits.

At Indianapolis this year, the AAAS Annual Exposition of Science and Industry will be especially rich in displays of advances in pharmaceuticals and electronics and of the components and adjuncts of jet aircraft and guided missiles. This is apparent from the list of this year's exhibitors and the descriptions of their exhibits which is to be found in subsequent pages of this issue. The 1957 Exposition is worth a trip to Indianapolis for itself alone. We hope those who are going for the sessions will not fail to budget time for an adequate survey of the Exposition.

The exhibitors have much to offer visiting scientists and, conversely, they may receive much in return. The representatives of the participating firms, in addition to showing their latest aids for science, may also be able to provide just the bit of information or the helpful suggestion on techniques that one can use; in return, they will welcome expressions of new needs or requirements from those they serve.

During the brief span of the meeting period, both those who produce the tools of science and those who use them have opportunities to meet each other on a scale that dwarfs the number of calls the same representatives can make to widely scattered campuses, when, also, scientists may be pre-occupied with their daily activities. The exhibitors and the scientists meet each other not primarily to place or accept orders at the moment, but essentially to exchange information in a way that no printed brochure or sales letter can match.

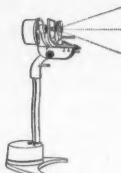
In a literal sense, the actual display of the latest in books, instruments, and laboratory supplies—or some of the most recent technological advances of industry—are three-dimensional, tangible information pieces, willingly explained to all who are sufficiently interested to pause before a booth.—RAYMOND L. TAYLOR



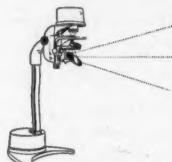
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## Antibiotics in Food Preservation

Public Health and Regulatory Aspects

Henry Welch

The extension of the uses of antibiotics to fields other than prophylaxis and therapy of human disease has magnified the problems of the U.S. Food and Drug Administration from the standpoint of side reactions and possible significance to public health. Antibiotics are used in animal nutrition for promotion of growth in swine, chicks, and poults. Therapeutic and prophylactic use of large quantities of antibiotics is made for animals such as cows, beef cattle, swine, chicks, and mink. These drugs are now being used as crop sprays to prevent blight in apples, pears, walnuts, and beans and bacterial diseases of tobacco, tomatoes, peppers, and cherries. Studies have been made to show the value of antibiotics in the preservation of vegetables, fish, beef, ham, chickens, and other perishables.

The actual or potential introduction of antibiotics into the food supply poses the same problem as does the use of any other chemical, and this growing use of chemicals in food is one of the most serious problems facing the Food and Drug Administration. It should be emphasized, however, that the problem of contamination of foods with antibiotics is a small one compared with our other problems of food safety. There is virtually no limit to the expanding list of chemicals that may find their way into our food supply. Chemicals are promoted as stabilizers, preservatives, disinfectants, antioxidants, extenders, tenderizers, emulsifiers, growth promoters, fumigants, herbicides, defoliants, fungicides, miticides, bleaches, sweeteners, conditioners, colors, and flavors. In addition, food packages which incorporate new plastics, enamels, films, plasticizers,

catalysts, and coatings are further potential sources of food adulteration.

In 1942 when penicillin was first introduced into this country, it is questionable whether anyone realized that this event was the beginning of a new billion-dollar industry. During the first year of commercial production, about 29 pounds of penicillin were made available. In this past year, over 960,000 pounds were produced. Total antibiotic production was 2.5 million pounds in 1956. It need not be emphasized here that these drugs have had very wide and, in some cases, indiscriminate use. Their remarkable curative powers, more pronounced perhaps in the early days than now, resulted in their being injected, insufflated, given by mouth, spread on every part of the body, and sprayed intra-abdominally, intracavernally, intrapleurally, and intravaginally; no surface or cavity of the body has remained inviolate. There are over 400 preparations of antibiotics available for clinical use today, and they run the gamut of injectables, ointments, powders, sprays, capsules, syrups, ear and eye drops, suppositories, troches, tablets, and vaginal bougies. Antibiotics have saved tens of thousands of lives in the past 14 years, and the reduction in mortality, morbidity, and complications of diseases has affected the lives of millions.

### Side Reactions

Nevertheless, with such major advances in therapy we unfortunately have to face the accompanying untoward side reactions. These invariably follow. In the case of penicillin, a relatively atoxic

drug, the "side reaction" is its potentiality for sensitizing certain unfortunate individuals. Although the other antibiotics are, in general, poor sensitizers, other side reactions may occur following their administration.

It is estimated that about 10 percent of our population has a tendency to become sensitive, in the course of a lifetime, to some food, drug, cosmetic, or other substance, while the great majority of individuals are resistant. Within this 10 percent there is a great variation in susceptibility to sensitization. Some acquire it easily, while others are more resistant. Some may be sensitive on first contact (the atopic group), while others require one contact, and still others may require several contacts, before exhibiting a reaction. The reactions, too, vary in degree from mild, transient rashes to prolonged urticaria and from a brief asthmatic attack to fatal anaphylactoid shock. Allergic manifestations occur less frequently in children.

Antibiotics are probably our most important and most widely used therapeutic agents. It is unlikely that any one of us will go through life without having antibiotics administered to us by our physician for sound medical reasons. Thus, with a population for this country of over 170 million, according to the most recent figures, we are concerned primarily with perhaps 17 million people who may react to a contact with antibiotics, be it through its therapeutic use for some disease condition or, inadvertently, through eating or drinking foods containing them. In the first case the physician and patient have a choice, but in the latter instance there is none.

### Antibiotics in Animal Feed

Antibiotics used for stimulation of growth are usually present in feed in small amounts (5 to 20 parts per million). When antibiotics are used in these quantities, antibiotic residues are not found in the blood or tissue of the animal. When 50 to 200 parts per million are used for prophylactic or therapeutic purposes in feed for chicks or poults, it may be demonstrated that there are residues in the tissues during the period in which the animal is being fed these higher concentrations. However, the anti-

Dr. Welch is director of the Division of Antibiotics of the U.S. Food and Drug Administration.

biotics are rapidly excreted within a few days after the drug is withdrawn. The use of antibiotics as described above, under present normal marketing conditions, does not, in our opinion, constitute a public health hazard. Antibiotics used as crop sprays are dissipated before the edible portion of the plant is formed, and since they do not reach the consumer, no public health problem is involved.

### Food Preservation

Extensive experiments have been conducted to explore the potentialities of antibiotics as food preservatives. In November 1955 the Food and Drug Administration approved the use of chlortetracycline for the preservation of raw poultry, and about one year later similar approval was given for oxytetracycline. Tolerance levels for these drugs were established under the provisions of the Miller Pesticide Chemicals amendment to the Food, Drug, and Cosmetic Act, passed by the 83rd Congress in 1954. These drugs act as preservatives and extend the "shelf life" of the fowl. Under the Miller amendment, the applicant must demonstrate "usefulness" to the satisfaction of the Department of Agriculture and "safety" to the Food and Drug Administration. The tolerance level for both chlortetracycline and oxytetracycline in the raw bird was established at 7 parts per million, in any part of the bird. Before approval of this tolerance level was granted, it had to be shown that no significant antibiotic residues could be found in the poultry after cooking by broiling, frying, boiling, or baking. A considerable number of investigations of the usefulness of antibiotics in the preservation of fish and meats have also been completed. However, approval of such uses by the establishment of tolerance levels under the Miller amendment can be obtained only when conclusive evidence is presented that such use is not detrimental to the health of the general public.

### Indirect Adulteration

In addition to being directly introduced in these ways into the food supply, antibiotics may also find their way into foods indirectly. In 1948 it was first noted that when milk from cows that had been treated for mastitis by intramammary infusion was mixed with antibiotic-free milk for the purpose of making cheese, failure to produce a satisfactory cheese product often resulted. This was due to the inhibition of the starter culture used in cheese manufacture by the antibiotic present in the milk. Realizing that anti-

biotics might also reach the consumer by way of milk, the Food and Drug Administration, by regulation, required that mastitis preparations carry a warning in their labeling to the effect that "milk from treated segments of udders should be discarded or used for purposes other than human consumption for at least 72 hours after the last treatment." In further recognition of the possibility that antibiotics might get into the food supply, a statement of policy was issued in February 1953 by the Secretary of the Department of Health, Education, and Welfare concerning the direct or indirect addition of antibiotic drugs to foods for human consumption. In effect, the policy statement was as follows: "The presence of antibiotic drugs in foods intended for human consumption, or the direct or indirect addition of such drugs to such foods, may be deemed an adulteration within the meaning of section 402 of the Federal Food, Drug, and Cosmetic Act."

Very large amounts of antibiotics are used in the treatment of milk-producing cows infected with mastitis. It is estimated that more than 75 tons of these drugs are used yearly in the treatment of this widespread infection. The great bulk of infected cows are treated by udder infusion, and a variety of products are available for this purpose. Penicillin is perhaps used in the greatest volume, since this drug is quite effective in those cases caused by streptococci, particularly *Streptococcus agalactiae*, the organisms responsible for most cases of mastitis. However, the disease is also caused by other organisms, such as the corynebacteria and the *coli-aerogenes* group of organisms, and, as a result, other antibiotics, such as dihydrostreptomycin, streptomycin, the tetracyclines, neomycin, and bacitracin, and the sulfonamides are used for treatment and prophylaxis.

Treatment usually consists of application of a single tube or injection of a syringe full of the preparation for each infected quarter of the udder, but as many as four treatments, at 12-hour intervals, may be necessary per quarter. Thus, in a single treatment, an animal that is being treated with a combination preparation may be given 500,000 units of penicillin, 500 milligrams of dihydrostreptomycin, 50 milligrams of neomycin, and 750 milligrams each of sulfanilamide and sulfathiazole. If the infection is severe, the animal may receive as much as four times these amounts within a 48-hour period.

When the antibiotic preparation used is effective, the clinical result is quite dramatic, and a marked change in the appearance of the teat and udder takes place within 24 hours. However, the disappearance of the signs of infection and the consequent reduction of inflamma-

tion are no guarantee that the infection is eliminated. This can only be determined by bacteriologic examination of the milk. Certainly, a favorable change in appearance of the infected udder is no guarantee that the drugs infused have been completely absorbed or eliminated. As a matter of fact, experimental evidence points to the opposite conclusion. It is necessary to milk infected cows twice daily for a period of at least three days to be sure that the great bulk of the drugs has been milked out. Experience has shown that practically the entire amount of infused antibiotic is eliminated by regular milking over a period of three days. It appears that failure to observe the warning given in the labeling of mastitis preparations concerning the discarding of milk from treated cows is largely responsible for the presence of antibiotic residues in the milk supply.

### Surveys and Solutions

During the last three years (1954, 1955, and 1956), three surveys have been made of fluid market milk to determine its antibiotic content. In these surveys a total of 2274 samples were examined, and samples from all states were included. An average of 6.9 percent of the samples examined contained penicillin, in concentrations varying from 0.003 to 0.550 units per milliliter. Other dairy products tested, including powdered milk, evaporated milk, ice cream, butter, cheese, shell eggs, and broken eggs were found to be free from antibiotic residues.

The relatively large number of positive samples noted in the year that separated the first and second surveys caused some concern, and it seemed advisable to obtain some opinion on the possible public health significance of the presence of penicillin in these quantities in market milk. Accordingly, some 30 experts in the fields of antibiotic therapy, allergy, and pediatrics were asked to express their views on this matter. The majority of these experts believed that penicillin in these amounts is unlikely to modify the oral or intestinal flora, cause the emergence of resistant strains, or provoke sensitization of an insensitive person. However, the majority felt that such concentrations might possibly cause a reaction in a highly sensitive individual. Recently the Food and Drug Administration has taken three steps to alleviate the public health problem involved:

- 1) Through cooperation with the U.S. Department of Agriculture, an intensive program has been initiated to educate the farmer concerning the importance of discarding, or using for purposes other than human consumption, milk from cows treated for mastitis with antibiotic



drugs for a period of three days following the last treatment. In addition, the National Milk Producers Federation, which reaches some 500,000 farmers, is assisting in this education program through their state agents.

2) On 23 Jan. 1957 we published in the *Federal Register* notice of a proposal concerning the warning statement regarding disposition of milk from treated cows which is required in the labeling of antibiotic drugs intended for intramammary infusion. It was proposed that this warning be placed on the immediate container of the drug rather than in the literature accompanying it. This is now in effect.

3) On 9 Feb. 1957 a "Notice of Proposed Rule Making" was published in the *Federal Register*, limiting the penicillin content of mastitis preparations to 100,000 units per dose. This became effective on 12 August.

It is hoped that these three steps will alleviate the problem of antibiotics, particularly penicillin, being present in our milk supply. However, if these procedures are unsuccessful, it may be necessary to ban the use of penicillin in mastitis preparations in the United States.

### Complex Problem

The control of antibiotics in our food supply becomes more complex daily. We now have before us for consideration the use of chlortetracycline and oxytetracycline in fish as a means of extending "shelf life." Unfortunately, in contrast to demonstrations with poultry, we have been unable to demonstrate that ordinary methods of cooking treated fish (broiling, frying, boiling, or baking) eliminate the residual antibiotic. Furthermore, some fish are eaten raw,

smoked, or pickled, and in all these cases the consumer would ingest antibiotic residues. Before tolerance levels can be established for these antibiotics in fish it will be necessary for those requesting them to demonstrate that the residues found are not dangerous to public health.

As we attempt to feed more and more people better and better, and as more and more uses are found for antibiotics in foods, those charged with the responsibility of seeing to it that such foods are safe will find themselves in an increasingly difficult position. In the United States we plan to move slowly and cautiously in response to each new proposal concerning antibiotics in foods, keeping in mind the fact that if the public, or any unfortunate segment of it, has reservations concerning the safety of our food, it must at the same time question the effectiveness of our operations.

## AAAS Meeting in Indianapolis

Raymond L. Taylor

Since the appearance of the preliminary announcement of the fourth Indianapolis meeting, which will be held from 26 to 30 December, inclusive [*Science* 125, 1047 (24 May 1957)], the symposia and other programs listed there have been developed and augmented. From such program details as the names and addresses of the authors of the hundreds of papers, and from such data as the advance registrations and applications for housing accommodations, which have been received in increasing volume since July, it is quite apparent that this year's AAAS meeting—the 124th—will enjoy an excellent attendance and that all sections of the United States and many foreign countries will be represented.

The Annual Exposition of Science and Industry, as the alphabetical directory of exhibitors and the descriptions of their exhibits makes evident, will fill the large Egyptian Room of the Murat Temple and would in itself be worth a trip to Indianapolis.

As the outline of symposia shows, virtually no principal field of science will be neglected, and the number and variety

of special events, characteristic of AAAS meetings, are greater than usual. A conspectus of these follows.

### Conferences and Special Programs

In recent years, in addition to the Academy Conference, several conferences have become recurrent events at AAAS meetings. Also, not infrequently, interest in special subjects may develop to the point where a special program is arranged. These conferences and special programs are open to all who are interested.

*Academy Conference*; 28 Dec., morning, afternoon, evening.

*Conference on Scientific Editorial Problems*; 26 to 29 Dec., mornings and afternoons (five sessions).

*Conference on Scientific Manpower*; 30 Dec., morning and afternoon.

*Mathematics Instruction*; a program of AAAS Section A—Mathematics, co-sponsored by the National Council of Teachers of Mathematics and the AAAS Cooperative Committee on the Teaching of Science and Mathematics; arranged

by John R. Mayor, educational director, AAAS; 27 Dec., morning.

*Social Aspects of Science as Illustrated by the Radiation Problem*; a general session sponsored by the AAAS Committee on Social Aspects of Science, arranged by Chauncey D. Leake, chairman; 29 Dec., afternoon.

### AAAS Special Sessions

One of the characteristic and most important features of the annual meetings of the Association is the series of outstanding general addresses by distinguished experts, sponsored by organizations that meet regularly with the AAAS. These special events are joint sessions with the Association and are open to the general public of the city in which the meeting is held.

*Special Address of the Biometric Society, Eastern North American Region*; 27 Dec., morning; Boyd Harshbarger, department of statistics, Virginia Polytechnic Institute, and president, Biometric Society, Eastern North American Region, presiding. "Smoking and Lung Cancer: An Example of the Interpretation of Statistical Data in the Observational Sciences," by Sir Ronald A. Fisher, Arthur Balfour professor of genetics, Cambridge University, England.

*Joint Annual Address of the Society of the Sigma Xi and the Scientific Research Society of America*; 27 Dec., evening; George H. Boyd, dean of the Graduate School, University of Georgia, and president, Society of the Sigma Xi, presiding. "The Fickle Fashions of Science," by Crawford H. Greenewald, president, E. I. duPont de Nemours and Company.

Inc. Edward R. Weidlein, director, Mellon Institute for Industrial Research, and chairman, Scientific Research Society of America, will award the William Procter prize. Wallace R. Brode, president elect, American Association for the Advancement of Science, will represent the AAAS.

*Annual Address of United Chapters of Phi Beta Kappa*; 27 Dec., evening; A. Logan Steele, president, Indianapolis Association of Phi Beta Kappa, presiding. "A long search for understanding," by Elvin C. Stakman, emeritus chief, Division of Plant Pathology and Botany, University of Minnesota, and past president, AAAS. Laurence H. Snyder, president, American Association for the Advancement of Science, will represent the AAAS.

*AAAS Presidential Address*; 28 Dec., evening; Laurence H. Snyder, dean of the Graduate School, University of Oklahoma, and president of the AAAS, presiding. "The inexorable problem of space," by Paul B. Sears, director, Conservation Program, Yale University, and retiring president of the AAAS. Preceding the address, A. H. Fiske, vice president of Eli Lilly and Company and general chairman of the Indianapolis meeting, will speak briefly. Following the address there will be an informal AAAS presidential reception in the ballroom and adjacent rooms of the Hotel Claypool. All registrants and members of the local committees are cordially invited to attend.

*General Session Sponsored by AAAS Committee on Social Aspects of Science*; 29 Dec., afternoon; Chauncey D. Leake, Ohio State University, chairman of the committee, presiding. "Social Aspects of Science as Illustrated by the Radiation Problem."

*Annual Lecture and Film of the National Geographic Society*; 29 Dec., evening; Paul A. Scherer, treasurer of the AAAS, presiding. "The Bounty and Pitcairn Island," by Luis Marden, foreign editorial staff, National Geographic Society.

## Religious Events

*Science Sunday Service and Mass*; Sunday, 29 Dec., morning; Cathedral of Saints Peter and Paul; sponsored by the Albertus Magnus Guild, the Most Reverend Paul Schulte, Archbishop of Indianapolis, presiding. "Man—the master of science," by the Rev. Francis J. Reine, president, Marian College, Indianapolis. All visiting scientists are welcome.

Downtown Protestant churches extend a welcome to all visiting scientists for their morning services and will give special recognition to the importance of the AAAS convention and to its religious implications.

*Luncheon and Business Meeting of the Albertus Magnus Guild*; Sunday, 29 Dec., 2:30 P.M.; Marian College Dining Room; E. M. K. Geiling (University of Chicago), president, Albertus Magnus Guild, presiding.

*Protestant Interdenominational Service*; Sunday, 29 Dec., afternoon; Roberts Park Methodist Church; "An honest faith," by D. Elton Trueblood, professor of philosophy, Earlham College, Richmond, Indiana, and author of *Philosophy of Religion*.

## Symposia

*AAAS General Symposium*. "Ideas That Mold Our Work."

*Mathematics*. "Mathematics Instruction"; "Mathematics of Guided Missiles"; "Computer Research and Applications"; "The Teaching of Mathematics."

*Physics*. "Wavelength Standards and Problems of Vacuum Ultraviolet Spectroscopy"; "Spectra of Lanthanides and Actinides: Isotope Shift"; "Theory of Spectra: Applied Spectroscopy"; "Some Recent Advances in Physics."

*Chemistry*. "Acetylene Chemistry" (two sessions); "Pyridine Chemistry" (two sessions); "Significant Trends in the Chemistry of Disease."

*Astronomy*. "Cepheid Variable Stars."

*Geology and Geography*. "Continental Glaciation and Its Geographic Importance as an Environmental Factor" (four sessions); "Mississippian and Pennsylvanian Rocks of the Midwest" (two sessions); "Karst Phenomena"; "Cave Fauna of the Ohio River Valley."

*Zoological Sciences*. "Current Understanding of Pituitary Function"; "Low Level Irradiation" (two sessions).

*Biological Sciences*. "Some Unsolved Problems in Biology, 1957." Part I: "Geographic Distribution of Contemporary Organisms"; Part II: "Biochemistry and Embryology."

*Botanical Sciences*. "Polarity, Heads or Tails?"

*Psychology*. "Human Engineering: Research Planning for Space Flight"; "Psychopharmacology"; "Effects of Early Experience on Behavior"; "Contemporary Research on Psycholinguistics"; "Decision Theory, Signal Detection, and Psychophysics"; "Problems and Progress in Statistical Learning Theory."

*Social and Economic Sciences*. "Social Aspects of Urban Agglomeration"; "Current Researches on Population"; "Advances in Theoretical Criminology and Penology"; "Advances in Interdisciplinary Approaches to Crime and Delinquency"; "Police-Crime Symposium"; "Advances in Police Administration"; "Advances in Scientific Crime Detection."

*History and Philosophy of Science*.

"Can Science Provide an Ethical Code?"; "Organization for Humans, Cells, and Artifacts."

*Engineering*. "Man and His Environment" (two sessions).

*Medical Sciences*. "The Human Integument—Normal and Abnormal" (four sessions); "Premedical and Preclinical Education"; "Space Medicine" (two sessions); "Rehabilitation of the Mentally Ill: Social and Economic Aspects" (four sessions).

*Dentistry*. "Physiology and Pharmacology of Fluorides" (three sessions).

*Pharmacy*. "A Pharmacological Approach to Mental Illness"; "Recent Trends in Medications"; "Metric Implementation in Pharmacy, Medicine, and Chemistry."

*Agriculture*. "Biological and Chemical Control of Plant and Animal Pests" (four sessions).

*Industrial Science*. "Science, Technology, and General Welfare in a Capitalistic Society"; "Some Areas in Industrial Microbiology."

*Education*. "Problems of Gifted Children"; "Teaching the Major Concepts"; "Methods and Techniques—Problem Solving in Biology"; "Strengthening Some Classroom Foundations"; "The Junior Museum and Its Relation to the Public Schools"; "Stimulating Interest in Nature Study"; "Natural History of Indiana and the Midwest"; "Teacher Certification—Content versus Method—Marriage or Divorce"; "Implementation of Recommendations of Chicago Conference on Junior Academics."

## AAAS Business Sessions

*Meetings of the Board of Directors*. The Board of Directors of the Association will meet after breakfast in a private suite of the Hotel Claypool, at 9:30 A.M., Friday, 27 Dec. Dates and hours of subsequent sessions of the board during the Indianapolis meeting will be decided at this session.

*Council Meetings*. The Council of the Association will meet Friday afternoon, 27 Dec., at 4 P.M. in the Chateau Room, Hotel Claypool. A second session of the Council is scheduled for Monday, 30 Dec., at 9 A.M. in the same room. All members of the Council have been notified individually, and it is hoped that all can attend. Subjects to be considered by the Council (in addition to the agenda prepared) are usually first brought before the Board of Directors through the executive officer of the AAAS. During the meeting, communications for the Board of Directors should be submitted in writing and left at the Hotel Claypool mail desk, addressed to Dael Wolfe.

*Meeting of all Section Chairmen and Section Secretaries*. There will be a

luncheon and business meeting of the officers of all AAAS sections on Sunday, 29 Dec., in the Empire Room, Hotel Claypool, at 12 noon. Dael Wolfe and Raymond L. Taylor will be cochairmen.

### Hotel Headquarters

The Hotel Claypool is the official headquarters of the AAAS for the Indianapolis meeting; there the Council of the Association will meet and other business sessions will be held. The press room—for receipt of authors' abstracts and distribution of press releases—is in the Florentine Room on the mezzanine floor.

The Main Registration-Information Center, the Visible Directory of Registrants, the AAAS Office, the AAAS Science Theatre, and the Annual Exposition of Science and Industry are all in the Murat Temple.

A list of the headquarters of the 18 sections and participating societies follows; (the societies are grouped in the same sequence as the letters of the sections with which they are affiliated).

#### Downtown Zone

*Claypool.* AAAS; Press; AAAS Sections F (Zoological Sciences), G (Botanical Sciences), M (Engineering), and N (Medical Sciences); American Society of Zoologists, Society of Systematic Zoology; American Society of Naturalists, Beta Beta Beta Honorary Biological Society, Biometric Society, ENAR, Ecological Society of America, Genetics Society of America, Society of General Physiologists; American Society of Plant Physiologists, Botanical Society of America; Engineering Manpower Commission; Alpha Epsilon Delta, American Medical Association Committee on Cosmetics, American Physiological Society, American Psychiatric Association, Society for Investigative Dermatology; National Association of Science Writers, Scientific Research Society of America, Sigma Delta Epsilon, Society of the Sigma Xi, United Chapters of Phi Beta Kappa; U.S. Atomic Energy Commission, Argonne National Laboratory.

*Sheraton-Lincoln.* AAAS Sections H (Anthropology), I (Psychology), K (Social and Economic Sciences), and P (Industrial Science); American Economic Association, American Political Science Association, American Sociological Society, American Statistical Association, AAAS Committee on the Social Aspects of Science, Association for the Psychiatric Treatment of Offenders, Institute for Research on Crime and Delinquency, Metric Association, Midwest Conference of Political Scientists, National Academy of Economics and Political Science, Pi Gamma Mu, Society for the Advancement of Criminology; American Industrial Hygiene Association, Society for

Industrial Microbiology (Washington Section); Conference on Scientific Manpower, National Academy of Sciences-National Research Council, National Science Foundation, Scientific Manpower Commission.

*Antlers.* National Association of Biology Teachers; National Association for Research in Science Teaching, National Foundation for Junior Museums, National Science Teachers Association; American Nature Study Society.

*Continental.* AAAS Sections A (Mathematics), B (Physics), and E (Geology and Geography); Association for Computing Machinery, National Council of Teachers of Mathematics; American Meteorological Society, Sigma Pi Sigma; Association of American Geographers, Geological Society of America, National Geographic Society, National Speleological Society; AAAS Cooperative Committee on the Teaching of Science and Mathematics; American Geophysical Union.

*Severin.* AAAS Sections C (Chemistry), Nd (Dentistry), Np (Pharmacy), and Q (Education); American Association of Clinical Chemists, American College of Dentists, American Dental Association, International Association for Dental Research; American Association of Colleges of Pharmacy, American College of Apothecaries, American Pharmaceutical Association (Scientific Section), American Society of Hospital Pharmacists, National Association of Boards of Pharmacy; American Educational Research Association, International Council for Exceptional Children, National Association for Gifted Children; Academy Conference.

*Warren.* AAAS Section L (History and Philosophy of Science), Philosophy of Science Association, Society for General Systems Research.

*Washington.* AAAS Section O (Agriculture); Conference on Scientific Editorial Problems, Society of Technical Writers and Editors.

#### North Zone

*Marott.* AAAS Section D (Astronomy), American Astronomical Society, Astronomical League, Indiana Astronomical Society.

#### Facilities for Eating

Throughout the meeting period, light refreshments and popularly priced cafeteria-style meals will be available in the Murat Temple. Also, luncheon facilities will be made available at Turners Athenaeum, diagonally across the street, through special invitations which can be obtained by guest card applications at the AAAS Office.

The restaurants and public eating places in Indianapolis, in addition to the

hotel coffee shops and dining rooms, are so numerous and varied that it is not feasible to list them here. For those who are interested, however, data will be available at the AAAS Information Center in the Murat Temple.

Those who wish to join the Association at this time are cordially invited to visit the headquarters of the AAAS New Member Service, at the Annual Exposition of Science and Industry, in the Egyptian Room, Murat Temple.

### Registration

*Main Registration-Information Center.* The AAAS Main Registration-Information Center is located in the lobby of the Murat Temple. It will be open daily 26-30 Dec., 8 A.M. to 6 P.M., with the exception of Sunday, 29 Dec., when it will remain open till 11 P.M. to accommodate any nonregistrants who wish to attend the AAAS Smoker.

Badges and General Programs may also be obtained at the supplementary registration desks, but the Main Registration Center is the only place where one can receive supplementary literature, maps, and the like. Advance Registrants (who have received programs and badges prior to the meeting) are urged to visit the Main Registration Center, at any convenient time, to receive these additional items.

*Supplementary registration desks.* For the convenience of those attending the 124th meeting, there are four supplementary hotel registration desks, as follows: Hotel Claypool, 26 Dec., 9 A.M. to 9 P.M., 27 Dec., 8 A.M. to 8 P.M., 28 Dec., 8 A.M. to 8 P.M., 29 Dec., 8 A.M. to 8 P.M.; Hotel Antlers, 26 Dec., 11 A.M. to 9 P.M., 27 Dec., 8 A.M. to 8 P.M., 28 Dec., 8 A.M. to 8 P.M.; Hotel Continental, 26 Dec., 1 P.M. to 9 P.M., 27 Dec., 8 A.M. to 8 P.M., 28 Dec., 8 A.M. to 8 P.M.; Hotel Severin, 26 Dec., 1 P.M. to 9 P.M., 27 Dec., 8 A.M. to 8 P.M., 28 Dec., 8 A.M. to 8 P.M.

Guests at the hotels Sheraton-Lincoln and Washington will find the Claypool convenient for registration; guests at the Warren will find the Severin convenient. Astronomers will register at the Hotel Marott, 27 Dec., 2 to 6 P.M.

*Registration fee.* The AAAS registration fee, which, intentionally, has been kept at a minimum, is \$3 for all; a spouse or child not wishing a separate Program may register for \$1, if registering at the same time. Each registrant receives a receipt, a convention badge, and the General Program-Directory—the only publication that contains the programs of the 18 AAAS sections and of the 66 participating organizations. Any person who purchases an advance copy of the General Program-Directory but does not register in advance, and who then attends the meeting, has agreed to com-



plete his registration—and is expected to do so—at the Main Registration Center or at one of the four supplementary registration desks; after this he will receive his convention badge and the privileges that go with it.

**AAAS convention badge.** Every thoughtful person will wish to register and thus pay his share of the expenses of the meeting. Your AAAS convention badge will indicate that you are a complete participant in the 124th Convention of the Association. The badge should be worn throughout the meeting because it reminds others to register, it is needed for admission to the AAAS Science Theatre, the AAAS Smoker, and the reception that follows the presidential address, and it helps your friends to find you.

**Visible Directory of Registrants.** The Visible Directory of Registrants is located, for the maximum convenience of all, on the second floor of the Murat Temple, near the Annual Exposition of Science and Industry. The hours it will be open correspond exactly with the hours the Main Registration Center is open—daily from 8 A.M. to 6 P.M. The registration cards of all registrants are placed in the Visible Directory as soon as possible after registration. The arrangement is alphabetical. The cards of advance registrants are *completely* alphabetized and typed, since they will have been posted in Washington prior to the meeting; all other registration cards are filed to the second or third letter of the surname (*Ba, Be, etc.*). Members of the press, exhibit personnel, and guests are included in the Visible Directory—on *blue* cards instead of yellow. Registrants will find the Visible Directory invaluable in determining the convention addresses of friends attending the meeting.

**Mail, telegrams, and messages.** Mail and telegrams addressed in care of the AAAS will be held at the AAAS Office in the Murat Temple. Efforts will be made to notify addressees listed in the Visible Directory, but the Association assumes no responsibility for the delivery of mail or of telegrams. Telephone and personal messages will be filed alphabetically in the AAAS Office, and the names of those for whom they are intended will be posted on a bulletin board.

**Tickets to society dinners or luncheons.** Tickets to the dinners or luncheons of any participating society are obtainable only from representatives of that society, either during preceding sessions of that society or at the AAAS Information Center.

#### Local Travel Directions

At the 124th meeting, the fact that the Murat Temple, World War Memorial, and the downtown hotels have

numerous public rooms has made it possible for almost all the sessions to be held in one compact area, with no hotel more than a few blocks from the Hotel Claypool or the Temple, all within walking distance. For those who desire transportation, taxi fares are moderate (several passengers are carried for a single fare), and there are special buses.

**AAAS chartered-bus shuttle service.** During the period of the meeting, the Association will operate regular Indianapolis Transit System buses, marked "AAAS," between the downtown hotels and the Murat Temple. These buses will follow a circular route, with stops at the Antlers, Continental, Claypool, and Severin hotels, at the Murat Temple, and again at the Antlers. Buses will run on a ten-minute schedule immediately before and after sessions and at slightly longer intervals the rest of the day.

#### AAAS Public Information Service

Each person who will deliver an address or present a paper at the Indianapolis meeting is requested to provide the Association's Public Information Service with 100 copies of a nontechnical abstract of his paper. One hundred copies of *complete* manuscripts are also required of papers presented by (i) officers of the Association; (ii) officers and invited speakers who appear on the programs of the participating societies; and (iii) authors whose papers are particularly newsworthy. Most authors have already recognized the necessity of this procedure and have sent their material to the Association's director of public information, Sidney S. Negus, Medical College of Virginia, Richmond, Virginia. If you are to deliver an address or paper and have not done this, please send 100 copies of your nontechnical abstract to Dr. Negus, to arrive in Richmond on or before 15 Dec. If it is impossible for you to send this material to Richmond to arrive by 15 Dec. (*mails are much slower in the pre-Christmas period*), then mail all your material to Dr. Negus—or deliver it to him in person—at the AAAS Press Room, Florentine Room, on the mezzanine of the Hotel Claypool, before or during the convention. As an aid to the Association's Public Information Service, please send copies of your abstract to your local newspapers with indication of the time when the paper is to be presented in Indianapolis.

The necessity for keeping the general public informed of the results of the scientific research which it supports, directly and indirectly, is quite evident. Organized science and the individual scientist must have the understanding and support of all. It is, of course, equally important that the advances of science be publicized with accuracy and clarity,

without sensationalism. Progress in this direction in recent years has been very gratifying, thanks largely to members of the National Association of Science Writers, other accredited science reporters, managing editors of American newspapers, and program managers of radio and television stations.

It is in the interest of accuracy and completeness that science writers frequently wish to discuss various research results with investigators. If you are asked to cooperate in this respect or to participate in a press conference, please do so not only for your own protection but for the benefit of science in general. Scores of science writers will be covering this meeting. News stories filed by the representatives of all the wire services will be published and broadcast throughout the entire civilized world. At no other scientific meeting are the facilities for the dissemination of the most recent findings in all branches of science so complete as they are at the great, diversified meetings of the AAAS.

This year the Association is fortunate not only in having the continued services of Dr. Negus, chairman of the department of biochemistry, Medical College of Virginia, but also in its Local Committee on Public Relations, headed by James W. Carr, executive secretary, James Whitcomb Riley Memorial Association.

#### Tours and Points of Interest

At this meeting there will be no formal tours sponsored by the AAAS as a whole, but certain sections and participating societies have planned tours and field trips, as may be noted in their programs.

#### Points of Special Interest

The literature on Indianapolis—available to all registrants and distributed only from the Main Registration-Information Center, in the Murat Temple—displays and lists all principal local points of interest. The following are of special interest:

**Butler University** (Sunset Ave. between Hampton and 52nd Sts.). Take M2 bus.

**Benjamin Harrison home** (1230 N. Delaware St.). Open week days 10 A.M. to 4 P.M.; Sunday 12:30 P.M. to 4 P.M.

**Indiana State Library** (140 N. Senate Ave.). Open week days 8 A.M. to 5 P.M.

**Indiana Soldiers' and Sailors' Monument** (Monument Circle). Open daily 9 A.M. to 3:30 P.M.

**Indiana University Medical Center** (1100 Michigan St.).

**John Herron Art Institute** (16th and Pennsylvania Sts.). Open week days 9 A.M. to 5 P.M.; Sunday 1 P.M. to 8 P.M. Free on Saturday and Sunday.

**James Whitcomb Riley's home** (528



Lockerbie St.). Open 10 A.M. to 4 P.M. daily except Monday.

**State House** (facing Capitol Ave. at Market St.). Museum open week days 8 A.M. to 5 P.M.; closes at noon Saturday.

**World War Memorial** (Meridian St. between Michigan and Vermont Sts.). Open daily 10 A.M. to 5 P.M.

## AAAS Science Theatre

The AAAS Science Theatre, a permanent feature of the association's annual meeting, presents each year a selection of the latest domestic and foreign scientific films at intervals throughout the meeting period. The theatre will be on the stage of the Egyptian room of the Murat Temple, in immediate proximity to the Annual Exposition of Science and Industry. The association is greatly indebted to those who made and lent these films.

**Hours of the Science Theatre** are 9 A.M. to 1 P.M. and 1:30 P.M. to 5:30 P.M. on 27 and 28 Dec., 9 A.M. to 1 P.M. and 1 P.M. to 5 P.M. on 29 Dec., and 10:30 A.M. to 2:30 P.M. on 30 Dec.

### Friday Morning, 27 Dec.

**A Piece of Wood.** U.S. Department of Agriculture, Forest Service film. Color, 15 min.

**Antarctic Adventure.** Produced by the New Zealand National Film Unit. Black and white, 22 min.

**Natural Enemies of Insect Pests.** Produced by the University of California. Color, 27 min.

**American Indians of Today.** Produced by Encyclopaedia Britannica Films, Inc. Color, 16 min.

**The Life of the Molds.** Produced by Affiliated Film Producers, Inc., for C'.as. Pfizer & Co., Inc. Color, 28 min.

**Motion Picture in Medical Education.** Produced by the American Medical Association. Color, 30 min.

**Coronary Heart Disease.** Produced by Churchill-Wexler Films for the American Heart Association. Color, 6 min.

**The Copper Network.** Produced by Phelps Dodge Copper Corporation. Color, 23 min.

**Speaking of Air Power.** Produced by the Bendix Aviation Corporation. Color, 33 min.

**Man High.** Produced by the Columbia Broadcasting System. Black and white, 20 min.

### Friday Afternoon, 27 Dec.

**Machine Retrieval.** Produced by Smith, Kline & French Laboratories. Color, 13 min.

**High Blood Pressure.** Produced by Churchill-Wexler Films for the American Heart Association. Color, 7 min.

**Coccidioidomycosis, Its Epidemiologic and Clinical Aspects.** Produced by the Communicable Disease Center, U.S.

Public Health Service. Color, 19 min.

**The Spruce Bog.** Produced by the National Film Board of Canada. Color, 23 min.

**The Great Adventure.** Produced by Arne Sucksdorff, Sweden; distributed by Louis de Rochemont Associates. Black and white, 75 min.

**The Thunderbirds.** Produced by the U.S. Air Force. Color, 14 min.

**Man in Space.** Produced by Walt Disney Productions. Color, 35 min.

**Behavior of Explosives.** Produced by the Naval Ordnance Laboratory. Color, 29 min.

### Saturday Morning, 28 Dec.

**The Armour Research Reactor.** Produced by Atomics International, Division of North American Aviation, Inc. Color, 14 min.

**Our Friend the Atom.** Produced by Walt Disney Productions. Color, 50 min.

**Water for the West.** U.S. Department of Agriculture, Forest Service. Color, 25 min.

**A Report on Smog.** Produced by Stanford Research Institute. Color, 28 min.

**Disorders of the Heartbeat.** Produced by the American Heart Association on a grant from Wyeth Laboratories, Division of American Home Products, Inc. Color, 20 min.

**Formed Elements in the Peripheral Circulation.** Produced by George P. Fulton, Herbert J. Berman, and Kenneth A. Arendt, Boston University. Color, 30 min.

**The Story of the Blood Stream, Part I: The Heart and Circulatory System.** Produced by the Moody Institute of Science. Color, 28 min.

**Honey Bees and Pollination.** Produced by the National Film Board of Canada. Color, 30 min.

### Saturday Afternoon, 28 Dec.

Same as Friday morning, 27 Dec.

### Sunday Morning, 29 Dec.

Same as Friday afternoon, 27 Dec.

### Sunday Afternoon, 29 Dec.

Same as Saturday morning, 28 Dec.

### Monday, 30 Dec.

**Our Magic Land.** Produced by the U.S. Department of Agriculture and the U.S. Department of the Interior. Color, 17 min.

**Coronary Heart Disease.** Produced by Churchill-Wexler Films for the American Heart Association. Color, 6 min.

**High Blood Pressure.** Produced by Churchill-Wexler Films for the American Heart Association. Color, 7 min.

**Strokes.** Produced by Churchill-Wexler Films for the American Heart Association. Color, 6 min.

**An Introduction to Arthropod-Borne Encephalitis.** Produced by the Communicable Disease Center, U.S. Public Health Service. Color, 17 min.

**The Story of the Blood Stream, Part II. The Red Blood Cells.** Produced by the Moody Institute of Science. Color, 27 min.

**Man in Space.** Produced by Walt Disney Productions. Color, 35 min.

**Man High.** Produced by the Columbia Broadcasting System. Black and white, 20 min.

**The Great Adventure.** Produced by Arne Sucksdorff, Sweden; distributed by Louis de Rochemont Associates. Black and white, 75 min.

## Annual Exposition of Science and Industry

The large-scale AAAS Annual Exposition of Science and Industry will be located in the Egyptian room on the second floor of the Murat Temple. The exposition will be open to (i) all registrants who attend the meeting and (ii) interested adults who have applied for, and received, complimentary tickets of admission.

The hours of the exposition are as follows: Friday, 27 Dec., 9 A.M. to 5:30 P.M.; Saturday, 28 Dec., 9 A.M. to 5:30 P.M.; Sunday, 29 Dec., 9 A.M. to 5 P.M. and 8 to 10 P.M.; Monday, 30 Dec., 10 A.M. to 3 P.M.

## AAAS New Member Service—Science—AAAS Publications

Booth 37. Whether or not he is a member of the American Association for the Advancement of Science, every person attending this meeting is cordially invited to visit the AAAS booth for information concerning the association and its activities. Beyond the satisfaction of strengthening its work for science, for scientists, and for society by one's membership, there are demonstrable personal advantages in joining the association.

Since its founding, in 1848, the association has admitted to membership not only professional scientists but also other men and women who have a general interest in science, who wish to keep informed of the progress of science, and who would like to support the high purposes of the one organization that represents all science. The New Member Service will be pleased to accommodate those who wish to join the association as of January 1. Those who are already members can conveniently nominate others for membership.

Included in the annual dues of \$8.50 (for 1958), each member receives the new, enlarged *Science*, the scientific newsweekly, which also has the content of *The Scientific Monthly* just merged with it. Free sample copies will be distributed, and all who are not familiar with this leading journal of science should visit this booth, where symposium volumes and AAAS membership insig-

nia are also on display. Prospective advertisers may obtain sample copies of the magazine and the rate card.

#### AAAS-Traveling High School Science Library

Booth 38. The AAAS administers this experimental traveling library program at the request of and with the financial support of the National Science Foundation. The exhibit consists of the 200 books comprising the library which is being circulated to 216 senior high schools representing every state and the Territory of Hawaii. Two well-read high school students will be at the exhibit to discuss the books. The program's objectives are to interest young people in science, to assist those with an aptitude in science in the choice of a scientific career, and to demonstrate the kinds of books that should be purchased by high school and community libraries in order to satisfy the interests of young people and nonspecialist adults. An annotated list of the books in the library may be purchased for 25 cents, and a selected list of paperback science books is available for 10 cents.

Now in its third year of operation, the program has proved that it is fulfilling its objectives, and hundreds of school and community libraries are basing their new acquisitions on the list of books. Institutes for high school teachers sponsored by the National Science Foundation, and special summer workshops for promising high school students are using the traveling library books for collateral reading.

#### Ace Glass Incorporated

Booth 21. The primary feature of the Ace exhibit will be the famous Mini-Lab line of small-scale, interchangeable glassware equipment. Mini-Lab consists of a number of basic assemblies and components which can be arranged in various combinations, and has proved to be ideal for the study of chemical processes on a scale intermediate between true micro and conventional micro. In addition to Mini-Lab, the exhibit will feature Ace Trubore stirrers, wide-mouth reaction flasks of stainless steel and glass, a distilling head, and weighing bottles. Also displayed will be sintered glass filters, a McLeod gauge, and Ace's Rota-Kit, an accurate, general-purpose flow-rate test kit for measuring liquids and gases. The kit is portable and is specifically designed to meet the needs of research and pilot plant laboratories. A display of Kimble Glass Company's new Kimax glassware will be shown for the first time. Kimax is manufactured from a new borosilicate glass which is interchangeable with, and can be sealed to, present borosilicate glassware.

#### American Telephone and Telegraph Co., Indiana Bell Telephone Co., Inc., and Western Electric Co.

Booths 40, 41, and 42. The theme of this exhibit will be the Bell System science shows and their contribution to the advancement of science.

#### American Tobacco Company, Inc.

Booths 54 and 55. The exhibit of the Research Laboratory of the American Tobacco Company will display two full-color reproductions depicting the growing and curing of tobacco. Samples of the four main types of tobacco used in the manufacture of the modern American blended cigarette will also be on display. Representatives from the Research Laboratory will be in attendance and will answer questions concerning research and quality control in the American Tobacco Company. Technical literature will be available for distribution.

#### Arvin Industries, Inc.

Booth 7. Our exhibit will be based on research work that we have been conducting in the fields of laminates, foams, and sandwich structures. This work on laminates consists largely of the adhering of such plastic sheeting as vinyl and Mylar to steel, aluminum, hardboard, and so forth. The foam exhibit will be represented by vinyl foams and urethane foams in structures applicable to the automotive and furniture fields. Sandwich structures will represent the use of foams in table tops, desk tops, and wall paneling. We also will have exhibits of electrically heated, laminated paneling.

#### Association of American University Presses

Booth 20. Each university press represented in the exhibit is a separate publishing company producing technical, medical, and scholarly works. This joint exhibit enables you to see books from a number of the university presses and, if you so desire, to order them direct from the booth or from the publishing press. A check-list of all of the books on display will be available.

#### Bendix Aviation Corporation

Booths 60 and 61. A scaled down model of a gas turbine engine which shows the general relation and function of the matched elements of an electronic fuel and engine control system built by Bendix will highlight the product display of the Bendix Products Division of the Bendix Aviation Corporation. Shown in the usual location and scaled down in size are models of main and after burner fuel metering units, the exhaust nozzle area control unit, and the amplifiers that work in conjunction with these components. Other items shown include the fuel pumps and all connecting wiring and

fuel lines and a jet engine ignition system built by the Scintilla Division of the Bendix Aviation Corporation. The Bendix electronic control system for jet engines is said to serve as an "electronic flight engineer." The airplane pilot needs only to "signal" for a change in engine thrust by moving a control lever into position to obtain the thrust desired.

#### Biological Abstracts

Booth 63. A more complete coverage of the world's biological literature, and a greatly improved abstracting and indexing service will be featured. In 1958 *Biological Abstracts* will collect, condense, classify, and index at least 42,500 articles of biological research interest selected from some 2900 biological periodicals published throughout the world. This provides scientists with the largest and most comprehensive information service available in the field of biology, and is made possible only by the volunteer efforts of thousands of biologists, biological societies, and biological industries who have joined efforts to make this nonprofit, cooperative venture a success. Coverage of the Russian biological research literature will be doubled in the 1958 *Biological Abstracts* through the generous assistance of the Foreign Science Information Program of the National Science Foundation in providing the funds for translation. Because of the tremendous growth in biological research, originally published in thousands of journals in many languages, *Biological Abstracts* is even more necessary as an implement of research and teaching than ever before. A representative will be in attendance.

#### Cambridge University Press

Booth 52.

#### Coca-Cola Company

Booths 17 and 18. Ice-cold Coca-Cola will be served through the courtesy and cooperation of the Coca-Cola Bottling Company of Indianapolis, Inc., Indianapolis, Ind., and the Coca-Cola Company.

#### Consultants Bureau, Inc.

Booth 90. World's leading scientific translation company. Translations in 19 languages, by bilingual scientists, with special emphasis on Russian. Currently translating 28 Russian research journals (including four for the AIBS and three for the AIP), on yearly subscription basis; single articles also available. Definitive Russian-English physics dictionary will be published in 1959; interim glossaries available in nuclear physics and engineering, electronics, solid state, atomic physics, spectroscopy, optics, and so forth. Collections of papers from all our translated Russian journals, 1949-

1955, on catalysis, glass and ceramics, fused salts, and pharmaceuticals. Important symposia: Radiobiology; Radiation Chemistry; Remote Consequences, Injuries Caused by Ionizing Radiation. April 1957 All-Union Conferences on Applications of Radiation and Isotopes, in Biology, Chemistry, Physics, Metallurgy, Automation. Journal supplements, such as "Physics of fission," supplement to the *Soviet Journal of Atomic Energy*. Original Russian theoretical monographs, such as: "The Statistical Theory of Phase Transitions," by Geilikman, or "Quantum Electrodynamics," by Akhiezer and Berestetsky. Also custom translation.

#### George F. Cram Company, Inc.

Booth 83. The Cram booth will feature the beautiful Cram 16-inch illuminated celestial globe, designed as a visual aid in the study of astronomy. A celestial globe is a globe which shows selected stars of the celestial sphere. When we look out into the night sky, all the stars and planets seem fixed to a great sphere encircling the earth. Of necessity, a celestial sphere must be constructed so as to be seen from the outside, but in using this globe it is necessary to imagine one's self on the inside looking outward. When properly adjusted, then, the stars appear just as they would were you actually observing them in the sky. Also on display will be a representative of Cram's graded program of visual aids for the social studies, edited to the mental maturity of the student at each grade level.

#### Current Contents—

##### Eugene Garfield Associates

Booth 95. *Current Contents* features reproductions of advance or current tables of contents of 250 journals in human and veterinary medicine, physiology, pharmacology, pharmacy, and chemistry. By regularly scanning *Current Contents*, subscribers obtain up-to-date coverage of those publications reporting new information on drugs and chemicals and their physiological effects. The weekly, pocket-size booklets of contents pages enable the reader to cover conveniently and rapidly more publications than can be covered in routing procedures or visits to libraries. The *Current Contents* service also includes a reprint expediting service and a procurement service for purchasing single copies of individual journals. *Current Contents* is compiled by arrangement with the publishers of foreign and domestic periodicals, including several scientific societies, which provide advance of tables of contents. *Current Contents* is rapidly produced and provides more than 3500 current contents pages per year. Eugene Garfield Associates, a firm of information engineers, also publishes *Current Contents of Manage-*

ment Publications and other custom editions for individual organizations.

#### Delco-Remy Division, General Motors Corporation Booths 84, 85, 86.

##### Denoyer-Geppert Company

Booth 74. Denoyer-Geppert Company will display a wide variety of visual teaching aids for many subjects in the science field, with emphasis on biology and related areas of interest. Unbreakable plastic models will make up the main portion of the exhibit. There will be a fine array of colored wall charts. A greatly increased assortment of plastic embedded specimens will be available for inspection, along with the well-known museum jar preparations and representative samples from the D-G osteology laboratories. Among new items will be additional charts on the atomic theory. Denoyer-Geppert representatives will be on hand to demonstrate the visual appliances, and there will be ample opportunity to discuss problems of visual presentation.

##### Educational Testing Service

Booth 31. Tests, testing programs, research, and services for selection, guidance, scholarship competitions, placement, and educational evaluation. ETS develops tests for direct sale to qualified users in schools, colleges, business, governmental agencies, and professional associations; administers nation-wide testing programs; builds programs tailored to special needs; conducts fundamental research in measurement; and provides professional advisory services.

#### Folkways Records and Service Corporation

Booth 100. The products of the world's largest producers of authentic folk music illustrate, in phonorecord form (documented), the sounds, music, and cultures of many places and peoples of the world. Over 400 peoples have been recorded in the Ethnic Folkways Library, which includes background notes by leading social anthropologists and ethnologists. In its Science Series, Folkways has released record albums dealing with phenomena such as the rain forest, and sounds of the American Southwest, the "talk" of fish, and the happenings during an actual operation. A complete catalog is on display at the Folkways booth.

#### General Electric Research Laboratory

Booths 79 and 80. The General Electric Research Laboratory will exhibit samples of its man-made diamonds, which are now in extensive pilot-plant production at GE's Metallurgical Products Department, as well as another re-

sult of superpressure research: borazon. Borazon—cubic boron nitride—is the first material ever found to compare with diamond in hardness, and it easily resists temperatures at which diamond burns in air. Other items in the General Electric Research Laboratory exhibit will be the most recent versions of the laboratory's tiny ceramic vacuum tubes, some new types of miniature batteries, samples of a new silicon sheet material that is easily magnetized in four directions, and a motion-picture demonstration of a flame burning in the absence of convection.

#### General Motors Corporation, Allison Division

Booths 57, 58, and 59. A full-scale cut-away model of the Allison 501 prop-jet engine and Aeroproducts turbopropeller will comprise the exhibit of the Allison Division of General Motors Corporation during the 1957 Annual Exposition of Science and Industry of the AAAS.

The model 501 prop-jet engine incorporates all the improvements and refinements developed through years of experience by Allison, America's pioneer producer of turbine aircraft engines. The prop-jet engine—like a straight turbo-jet—is a turbine engine. Instead of delivering its power through "jet" thrust, the engine delivers its power through Aeroproducts turbopropellers, also designed and produced by the Allison Division.

The turbine drives at 13,820 revolutions per minute a turbine shaft which is connected to a gear box. The gear box transmits this tremendous power from the turbine shaft at a reduced speed of 1020 revolutions per minute to the propeller. The jet exhaust itself furnishes an additional 10 percent thrust. The Allison model 501 prop-jet engine and Aeroproducts turbopropeller run at constant speeds throughout the flight range. Regardless of whether the plane is taking off, climbing, cruising, or letting down for a landing, the engine and propeller are turning up 100 percent. Power is obtained by moving a single lever for each engine which meters the amount of fuel to the engine. While this change in fuel flow is taking place, the blade angle of the propeller changes. As the fuel flow increases, the propeller or blade angle becomes greater. For take-off and climb the pitch angle is greater than it is for normal cruising and let-down for landing.

The Allison model 501 prop-jet engine weighs only 1750 pounds; it is 145 inches long and 27 inches in diameter. Its approximate frontal area is only 5.4 square feet; this results in a much slimmer nacelle than that which can be used with a conventional piston engine. It produces 3750 horsepower, or nearly 2.3 horsepower per pound of engine weight.



The Allison T56 prop-jet engine, a military version of the model 501, and Aeroproducts turbopropellers power the USAF four-engine C-130 Lockheed Hercules combat-cargo transport plane now in operational service with the Tactical Air Command in the U.S. and Europe. The model 501 prop-jet engine and Aeroproducts turbopropeller will power America's first prop-jet commercial airliner, the four-engine Lockheed Electra.

#### **Graf-Apsco Company**

Booth 73. If you have any microscope troubles, it would be well to stop at Booth No. 73 of The Graf-Apsco Company, "America's Leading Microscope Repair House." Also exhibited are new Graf-Apsco microscopes with exclusive features designed into the stand to keep the instrument in good working order indefinitely. If you do not know what to do with your obsolete microscope, The Graf-Apsco Co. will buy it for cash or accept it in trade. Be sure to see this interesting exhibit.

#### **D. C. Heath and Company**

Booth 45. In these days of heavy class loads for teachers, the choice of textbooks assumes greater importance than ever before. We invite visitors to examine our college texts in chemistry, physics, biology, and botany; our high school texts in biology, chemistry, and physics; and our elementary school texts in science.

#### **Indiana Gear Works, Inc.**

Booth 2.

#### **International Harvester Company**

Booth 36. International Harvester will display industrial applications of experimental-stress-analysis tools and methods, developed in scientific and university laboratories, to the solution of practical problems in manufacturing and engineering. The exhibit will include multi-channel strain recorders, photoelastic methods of analysis, brittle lacquer strain-sensitive coatings, and electric resistance strain gages for use at normal and elevated temperatures. The value of participation in the activities of technical committees of national societies will be shown by results obtained in a program in residual stress measurement and effect undertaken cooperatively by 20 industrial and university laboratories.

#### **Jet Division,**

#### **Thompson Products, Inc.**

Booth 39. Processes used at the Jet Division in the production of precision assemblies that rotate at high speeds in elevated temperatures will be illustrated by lighted transparencies and animation. These processes include draw-forming of unusual alloys of steel and rare nonferrous metals, automatic welding in inert

atmospheres, machining, unusual heat treatment for extra strength, and several unusual types of inspection. Processes on display have been developed to provide aircraft and missile designers and manufacturers with mechanisms and structures capable of standing up under high stresses, high temperatures, and extremes of temperature encountered by piloted aircraft and missiles of every size. By animation, automatic welding of cylinders up to 10 feet in diameter will be illustrated. The five plants which house the Jet Division's complete development, engineering, production, and testing facilities are also shown.

#### **P. M. Lennard Co., Inc.**

Booth 62.

#### **Eli Lilly and Company**

Booths 11 and 12. Eli Lilly and Company's exhibit will illustrate the role of scientists and trained technicians required in the vast operations of the pharmaceutical industry, particularly in the areas of research, control, and development. As Eli Lilly and Company continues in its growth and multiplies its facilities to anticipate the future, the need for such qualified professional personnel becomes progressively more important. Consequently, the exhibit will point out the professional advantages of research work at Eli Lilly and Company, such as participation in challenging scientific work and association with leading research scientists. By illustrating these facets of the company, the exhibit will indicate the scientific advances achieved by Eli Lilly and Company in its traditional quest for improved medical health.

#### **P. R. Mallory and Company, Inc.**

Booths 77 and 78. "Tomorrow's Products Today" will be the theme of the P. R. Mallory exhibit at the Annual Exposition of Science and Industry, 26-30 December, in Indianapolis. A sound-slide presentation entitled "Electronics in your future" will give booth visitors a glimpse of flat-screen color, three-dimensional television; electronic heating, cooling, cooking, and air purifying; transistorized golf balls; Dick Tracy wrist radios; electronically controlled family automobiles; and superhighways with speed and safety governed by electronic brains in control towers. New Mallory developments in electronic components and the AAAS Section P citation-winning powdered iron will show what Mallory is doing to hasten tomorrow's electronic marvels. Part of the exhibit will tell the scientifically fascinating story of the new Mallory powdered iron—how it was developed after four decades of pioneering in powdered metallurgy, how it is processed, and how it will help designers make a reality of tomorrow's futuristic products for home and industry.

#### **Merz Engineering, Inc.**

Booth 19. Merz Engineering will exhibit a few of the products that have established for it a world-wide reputation for progressive engineering and manufacturing of highest quality precision products. Electronic gaging instruments, for laboratory and industrial use, that measure accurately up to one millionth of an inch, will be shown. Automatic gaging and sorting machines will be operating. Complete information on the manufacturing process of a disposable medicinal syringe will be available. The application of this product is another tremendous advancement in practical medical science. Merz Engineering personnel will be present to demonstrate equipment and to answer questions.

#### **Microcard Foundation**

Booth 1. Publishers of Microcard editions of scholarly source books, scientific and technical periodicals, research reports, and primary data in various disciplines of the physical and biological sciences; distributors of Microcard copies of the unclassified and recently declassified reports of the U.S. Atomic Energy Commission made available to the foundation by the Technical Information Service Headquarters, Oak Ridge, Tenn. The latest model "library" and "pocket size" Microcard readers as manufactured by the Microcard Corporation, West Salem, Wis., will be displayed. Literature describing specifications and prices of Microcard readers, cumulative catalogs listing all publications of the Microcard Foundation to date, and information concerning Microcard publication projects planned for the near future will be available without charge.

#### **Miles Laboratories, Inc.**

Booths 14 and 15. This exhibit will emphasize the research facilities and research program which support Miles Laboratories in its effort to serve the public. The centrally administered research organization also supports the subsidiaries and divisions of Miles Laboratories, Inc.: Ames Company, Inc., Sumner Chemical Division and Takamine Division. These affiliated organizations offer products for home medication, prescription pharmaceuticals, fine chemicals, and enzymes for industrial uses. The phrase "Behind the Label" is used as the theme of the exhibit to emphasize that a wide diversity of activities—research, control, product development, product testing, and substantiation—are essential to the development and maintenance of pharmaceutical products which can safely be offered to the public. A booklet "Behind the Label," which will shortly be ready for distribution, will be sent to those who indicate their interest by signing at the Miles Laboratories booth. This booklet will give in more detail the story of the



entire Miles organization and the many activities which must be carried out in order that the labels on Miles' products may mean that these products deserve public confidence.

#### **Miles Reproducer Company, Inc.**

Booth 35. You are urged to see a demonstration of the Walkie-Recordall, the light-weight, self-powered, briefcase-sized conference recorder. The recorder operates mobile or stationary, in a closed briefcase or as a separate unit—in office, field, car, train, plane, or boat. It picks up and records voice 60 feet away. No wires, no plugs. No installation or acoustical room conditions are required. Records clearly as surrounding noises are screened out. Perfect for recording of case histories, research, house calls, hospital rounds, lectures, conferences, interviews, group therapy, investigation, assembly panels, staff meetings, dictation, telephone conversations, and so forth. To adapt this conference recorder for dictation in noisy places, an optional built-in feature permits the exclusion of everything except the voice spoken or whispered close to the microphone. The voice-actuated "self-start-stop" optional feature automatically starts and stops the recording from microphone or telephone, thus eliminating supervision and the recording of silent periods. While facilities for transcribing are incorporated in the same unit, transcription may be eliminated due to ease of handling the inexpensive, identifiable, compact, indexed recordings without rewinding—a huge saving of clerical time. Up to 8 hours of permanent, unalterable recordings may be accumulated at intervals on a belt costing 25 cents.

#### **Moody Institute of Science**

Booth 34. This exhibit presents the cardiac pulse duplicator recently developed at Moody Institute of Science. This device makes the isolated human heart "beat" in a very realistic manner, simulating closely the hydrodynamic and muscular action of the living heart. By means of glass ports, the action of the heart valves can be studied or photographed, opening up new opportunities for instruction and research. The Moody Institute of Science produces science instructional films for classroom use. These films are designed to implement the moral and spiritual program, especially in elementary and secondary schools, and to excite the student's interest in scientific subjects and to encourage the selection of science as a life work. High levels of technical and photographic excellence are the goal.

#### **Muscular Dystrophy**

##### **Associations of America, Inc.**

Booth 8. This exhibit consists of three panels. (i) Color transparencies, with

descriptions, show the manifestations of muscular dystrophy; the genetics of the condition is discussed. (ii) Postural changes in early and late stages of progressive dystrophy are shown. (iii) Transparencies of personnel involved in various MDAA-sponsored research projects under the grants-in-aid program are presented; the dystrophic mouse, now being used in research, is shown and described. The Institute for Muscle Disease, now being built, is functionally described—an automatic play-back tape features an informational interview with the scientific director of the MDAA.

#### **National Geographic Society**

Booths 64 and 65. The exhibit of the National Geographic Society will feature the *National Geographic Magazine* and the *Geographic School Bulletins*. Also on display will be maps, books, pictures, and other special educational materials of the society. An automatic projector will screen a continuous selection of natural color slides. The slides cover National Geographic field assignments and expeditions and were selected from illustrations by staff photographers of the *National Geographic Magazine*.

#### **National Science Foundation**

Booth 75. The National Science Foundation is an independent agency of the Federal Government established by Act of Congress in 1950 to promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense. Its exhibit illustrates such foundation activities as (i) initiating and supporting basic scientific research through grants for research projects; (ii) awarding fellowships for graduate study and work, including postdoctoral; (iii) supporting programs for improving the quality of science teaching; (iv) fostering interchange of scientific information; (v) providing a clearinghouse for information about scientific and technical personnel; (vi) undertaking studies of scientific activity to help the Federal Government in making policy decisions about scientific research and education in the sciences; and (vii) co-operating in international scientific research activities.

#### **Oak Ridge Institute of Nuclear Studies**

Booth 72. The Oak Ridge Institute of Nuclear Studies is a nonprofit educational corporation of 36 southern universities, operated under contracts with the U.S. Atomic Energy Commission and the National Science Foundation. Its primary aim is the integration of the unique research facilities at Oak Ridge in the pattern of scientific education in the South. ORINS administers several AEC special fellowships; a research participation program through which university

faculty members carry out research at Oak Ridge; a graduate program for doctoral candidates who need the specialized Oak Ridge facilities for thesis research; a traveling lecture program which sends Oak Ridge scientists to speak on university campuses; and numerous other educational programs. The Institute also operates a medical-research hospital; a radioisotope-techniques training program; and, in the field of public education, an atomic-energy museum and traveling atomic-energy exhibits.

#### **Office of Naval Research**

Booth 89. The success of naval operations depends ultimately upon the abilities of the individual Navy man. Therefore, since its inception in 1946, the Office of Naval Research has supported a vigorous program of psychological research. Today's complex machines and operational procedures require ever-increasing degrees of skill and diversity on the part of the individual. Psychological research finds ways to select and train the individual for these complex tasks and to combine individuals and machines into efficient fighting units. Four major areas of research are depicted in the exhibit: personnel and training, physiological psychology, group psychology, and engineering psychology. Also shown are some of the typical research problems: how to select those who will work well together as a team; how to design equipment for maximum utilization; and the most efficacious training methods. These problems cover a wide range—from those affecting a pilot high above the earth, the men and ships on the surface, to the submariner below the sea. Today's technological advances include ultrasonic flight, atomic submarines, and electronic sensing mechanisms. But the success of naval operations still depends ultimately upon the skills of the individual which are constantly being improved as a result of psychological research.

#### **Pergamon Press, Inc.**

Booth 13.

#### **Pitman-Moore Company**

Booths 68 and 69.

#### **The Rayoscope Company**

Booth 16. At the Rayoscope booth, images of microscopic specimens will be projected on a screen at a distance so that a large number of people can observe simultaneously. Especial emphasis will be placed on projection of living specimens and on the minute detail of the projected image. Our specially designed lenses and pure white light source make it possible to show intricate detail of both living and stained specimens. You no longer have to be satisfied with generalities. Also, for the first time, a

revolutionary new type of projection screen will be demonstrated. This screen permits projection in a well-lighted room—even in a room such as a television studio where numerous flood lights are burning. For the best and finest in micro-projection, come to the Rayoscope booth.

#### Ronald Press Company

Booth 91. The Ronald Press Company invites members of the AAAS to visit booth 91 to see a representative display of Ronald Books, as well as the first comprehensive exhibit of *Chronica Botanica* books. Books at the Ronald booth represent the biological sciences, chemistry, conservation, engineering, forestry, geology, geography, history of science and technology, mathematics, philosophy, physics and astronomy, psychology and psychiatry, and sociology. Representatives of the company will be present.

#### The Science Center

Booth 10. The Science Center was organized in 1952 on a nonprofit basis as a personal philanthropy by William Guild to make available to teachers in the elementary grades a selection of classroom-tested projects in the fields of physics, chemistry, mathematics, geology, zoology, and electronics. There are now 106 projects from which teachers may make selections. This third annual exhibit at the AAAS convention also marks our twentieth preview for teachers.

#### The Science Library

Booths 3, 4 and 5. The Science Library is administered by the AAAS as an additional service to publishers of books, both exhibitors and nonexhibitors. It has become an integral part of each year's Annual Exposition of Science and Industry. In the Science Library, books of all publishers participating are grouped by fields of science—a convenience both to the visitor who is restricting his inspection of books to a single category, and to the one who wishes to browse. Among the publishers in the Science Library are: American Association for the Advancement of Science; Academic Press, Inc.; Addison-Wesley Publishing Company, Inc.; Annual Reviews, Inc.; Basic Books, Inc.; Cambridge University Press; The Chemical Publishing Co., Inc.; Consultants Bureau, Inc.; The Dryden Press, Inc.; Emerson Books, Inc.; Engineering Management Reports; W. H. Freeman and Company; Harpers & Brothers; Houghton Mifflin Company; Iowa State College Press; Josiah Macy, Jr. Foundation; C. V. Mosby Company; Prentice-Hall, Inc.; Reinhold Publishing Corporation; St. Martin's Press Incorporated; Charles Scribner's Sons; Simon and Schuster; University of Chicago Press;

University of Minnesota Press; University of Washington Press; D. Van Nostrand Company, Inc.; John Wiley & Sons, Inc.; The Year Book Publishers, Inc.

#### Ivan Sorvall, Inc.

Booth 96. Ivan Sorvall, Inc., Norwalk, Conn., will have on display a number of completely new Servall centrifuge developments, some of which are right in line with the modern trend toward automation. Shown in operation will be the Szent-Gyorgyi-Blum continuous-flow centrifuge for uninterrupted processing of large quantities of solution at high speeds. Also, the type SS-3 push-button superspeed (the first automatic unit in its range), the enclosed type SS-4 superspeed, the dependable Servall superspeed refrigerated centrifuge—all three of unmatched versatility; a new type GS large capacity, high-speed rotor; and some of the well-known smaller Servall table model centrifuges; the Servall Omni-Mixer and the improved Servall Porter-Blum microtome, both with a new range of accessories; a number of LBK chromatography instruments.

#### Special Libraries Association—Indiana Chapter

Booth 6. The Indiana Chapter of Special Libraries Association will exhibit materials showing the types of services offered by special libraries in academic, industrial, professional and public organizations with special emphasis on libraries in Indiana. A reference service designed to answer questions concerning scientific bibliography will also be maintained for the use of scientists attending the convention. Assistance will be available to those scientists and organizations who are seeking to employ librarians or to organize special libraries.

#### Stewart-Warner Corporation, South Wind Division

Booth 87. Stewart-Warner Corporation's South Wind Division will exhibit items taken from its activity in the field of airborne evaporative cooling. A cooling system, used on one of America's newest missiles, will be on display, and a new concept in evaporative heat exchanger design will be presented. The missile cooling system uses ammonia as a coolant. The major components are a coolant tank and an exchanger-blower combination. A special control maintains a constant outlet temperature regardless of heat load. The system is built as a unit for ease of servicing. During stand-by operations chilled water from a ground reservoir is pumped through the exchanger. At take-off an explosive valve closes the water line and admits ammonia

into the exchanger. Vapor is dumped overboard. The new concept in evaporative heat exchanger design is the result of a 3-year study to develop a compact, simple water boiler for aircraft and missiles. Basically, water, or any liquid coolant, is made to conform to any surface regardless of gravity or other external forces. This holding action is made possible without valves or baffles, and submerged boiling is thereby accomplished in a container far less bulky and complicated than current heat exchangers of comparable performance.

#### Joseph W. Still, M.D., George Washington University Medical Center—Permanent Aortic

#### Intubation in Rats—Scientific Uses

Booth 9. The exhibit outlines, in words and pictures, the surgical technique of performing the intubation procedure. It also shows pictures illustrating various uses of the preparations which have already been made and reported. In addition, it indicates some important further uses which have not been extensively exploited up to this time.

#### Street and Smith Publications, Inc.

Booth 88. *Science World*, the science magazine for high school students, will exhibit sample copies of recent issues and a display of premiums made available to subscribing teachers. Panels behind booth 88 will display a sampling of editorial coverage. A representative of the magazine will be present.

#### Tobacco Industry Research Committee

Booth 51. The exhibit describes the research program developed by the Scientific Advisory Board to the Tobacco Industry Research Committee. The program, covering all phases of tobacco use and health, has three main areas of investigation within which fall the separate, specific fields of investigation. The three main areas are: (i) the physical and chemical composition of tobacco and accompanying products, such as cigarette papers and additives; (ii) tissue changes in human beings and in animals exposed to tobacco or tobacco smoke, in normal life or under laboratory conditions; (iii) smoking and other tobacco habits and the comparative emotional and physical makeup of smokers and nonsmokers.

#### W. M. Welch Manufacturing Company

Booths 32 and 33. The W. M. Welch Manufacturing Company plans to display most of the selected apparatus used in physics, chemistry, and biology laboratories. These will include those especially adapted to the teaching of science in the secondary schools and colleges as well as some items specifically designed for special use in research and industrial laboratories. A partial list includes stain-

less-steel balances, high vacuum and smooth-operating vacuum pumps, electrical measuring instruments, electronics teaching devices, Densichron for measuring optical density, color saturation, paper chromatograms, and so forth. Many charts and other visual aids for teaching science, mathematics, and physiology, as well as preserved specimens, synthetic skeletons, and other biological models, will be shown.

#### Yellow Springs Instrument Company, Inc.

Booth 56. Yellow Springs Instrument Company will display our thermistor temperature-measuring devices, our new thermistor regulator, and some of our psycho-physiological equipment. The single-channel and multiple-channel telethermometers with a full display of interchangeable thermistor probes will be featured. Special noninterchangeable probes

mounted in hypodermic needles, and for use in catheters and tissue implantation, will be shown. Personnel will be on hand to answer questions on special temperature-measuring problems. The model 63 temperature regulator, a new low-priced, thermistor-based regulator sensitive to  $\pm 1^\circ\text{F}$  will be demonstrated. H. W. Trolander, president, and Raymond I. Schiff, sales manager, will be in attendance.

## News of Science

### Habitat of Early Vertebrates

The first vertebrates appear in deposits of the Ordovician period, which is dated some 450 million years ago. They were unquestionably aquatic forms; but the nature of their original habitat—whether marine, brackish, or fresh water—has been a moot subject. Some students—perhaps most—have favored a freshwater, fluviatile origin of vertebrates. Others, however, have argued for a marine origin. Still another view is that which adopts an intermediate position and regards the matter as debatable, believing that the widespread ostracoderm group of jawless fishes—the oldest and most primitive of known fossil vertebrates—had both fresh-water and marine representatives.

J. D. Robertson [*Biol. Rev.* 32, 156 (1957)] has recently reviewed the evidence bearing on this problem, considering both the geological and the morphological and physiological data. He regards the following points as indicating a marine habitat for the early vertebrates: (i) geochemical estimates that the early Ordovician seas were very similar in salinity and ionic composition to present-day seas, indicating that the first marine and fresh-water vertebrates likely were subject to the same physicochemical environmental stresses as those affecting present-day fishes and other marine chordates; (ii) common occurrence of the remains of early vertebrates (both Ordovician and Silurian) in association with those of marine invertebrates; (iii) the fact that all three existing protochordate groups (Hemichordata, Urochordata, Cephalochordata) are marine;

(iv) the high salt concentration of the internal medium in the cyclostome marine order Myxinoidea—equivalent to that of the surrounding sea water, as in marine Urochordata and marine invertebrates—possibly a primary character acquired directly from ancestral marine chordates; and (v) the presence of well-developed glomerular kidneys in the marine myxinoids and elasmobranchs, which suggests that this type of kidney probably existed in marine protovertebrates, subsequently becoming a useful preadaptation for life in fresh water.

Robertson thus concludes that the vertebrates were originally a marine group. The arguments that have been advanced for their fresh-water origin he rejects as either erroneous or improbable.

Although Robertson presents an interesting case for a marine origin, the evidence which he advances appears to be somewhat short of completely convincing, although, perhaps, no less convincing than the evidence which has been advanced for a fresh-water origin. The resultant dilemma is probably inevitable, since, as the author states in his introduction, any conclusions concerning the original vertebrate habitat "must always remain in the realm of probability."

—W. L. S. JR.

### International Physiological Expedition

The stress of antarctic weather on the human body will be studied by an international team of scientists from the University of California, Great Britain, and West Germany this winter. A six-

man group left Berkeley early this month to participate in the International Physiological Expedition to Antarctica, which is a merger of separate American and British research groups and which is being financed by the Office of Naval Research.

An American expedition, organized by Nello Pace, professor of physiology, and also financed by ONR, started a series of studies on Naval personnel in the "Deepfreeze I" expedition to Antarctica 2 years ago. The Berkeley group plans to follow up the earlier work, study personnel who have wintered in the polar region, and determine the effects of long exposure to the cold environment.

Meanwhile, in Britain, an expedition to make the first land crossing of Antarctica has been planned. The crossing will start from the Luitpold Coast of the Weddell Sea and proceed across the South Pole to the U.S. base at Ross Island in the Ross Sea. A New Zealand party led by Sir Edmund Hillary and based at Ross Island will act in support, traveling inland to establish a supply depot on the Beardmore Glacier on the last leg of the route.

The British Medical Research Council Laboratories has set up a program for physiological studies of the 15-man expedition. One British physiologist, Alan Rogers, will actually make the trek with the party. Two others, L. G. C. Pugh and James Adam, British Army medical officer, will meet the expedition at the terminus and carry out tests on the trekkers as well as on members of the New Zealand support group.

Other members of the International Physiological Expedition are Jack W. Millar, commanding officer of the U.S. Naval Medical Research Unit No. 1 at Berkeley; William E. Siri, of the Donner Laboratory, who is experienced in expeditions and will serve as operations director; and Gerhard J. Hildebrand, physiologist from Karlsruhe, Germany, who is joining Pace's laboratory staff.

The work of the expedition consists of two parts. First, detailed physiological observations will be made on personnel in Antarctica. For example, tests will be



made to determine the effect of the cross-continent hike on the heart, on body fluid volumes, body heat balance, and sensory perception. Second, fluid samples—blood and urine especially—will be taken from subjects, frozen, and returned to Berkeley for analysis. The analyses are expected to reflect the extent to which the environmental stresses derange body metabolism. In addition, saliva samples will be frozen for shipment to Berkeley, where studies of associations between certain types of oral flora and upper respiratory disease in cold environments will be made.

These studies will be important in the large program conducted by Pace and his colleagues to study human stress of many kinds. Many of these studies are carried out in the university's White Mountain Laboratory (14,250 feet) under the conditions of stress at extreme altitude.

### British Group Signs Manifesto

Forty-three British scientists have issued a manifesto urging all scientists to join them in using science for peaceful purposes only. The 43 are all members of the Religious Society of Friends. The British scientists take note of the recent statement by 18 German scientists [*Science* 125, 876 (3 May 1957)] and the Pauling petition [*Science* 125, 1190 (14 June 1957)]. Then they say: "We go further in refusing to cooperate in the production of any weapons of war."

### First Geological Map of Asia

A group of senior geologists, mainly from Asian countries, convened by the United Nations Economic Commission for Asia and the Far East, began a series of meetings last month in Calcutta, India, in order to complete the compilation of the first regional geological map of Asia and the Far East for publication next year. On the basis of this map, other maps will be prepared showing the distribution of mineral resources in the Asian region. At the first meeting, the group elected Sultan Ahman Popal of Afghanistan as chairman and U. B. Singh of Burma as vice chairman.

### Federal Funds for Medical Research

In contrast to the \$33,147,224,106 voted by Congress in fiscal year 1956 for military defense, only \$102,224,000 was voted for research against the major diseases in this country. This comparison is made in the 1957 edition of a study of heart diseases, cancer, mental illness, arthritis, blindness, nerve disorders, and

other health problems compiled by the National Education Committee, Inc., New York. The Federal allocation of \$102,224,000 which was made through the five National Institutes of Health, was compared by the committee with these Congressional appropriations: \$267,139,000 for design and testing of atomic weapons; \$116,000,000 for agricultural research service; \$51,000,000 for development assistance to Asia; \$62,980,000 for survey and construction of the Inter-American highway; and \$45,029,300 for the National Park Service.

### Paris Fuel Element Conference

Scientists from a number of countries recently participated in an unclassified conference on the technology of reactor fuel elements sponsored jointly by the atomic energy commissions of France and the United States. In addition to the host French scientists and a team of 20 U.S. specialists, representatives attended from the 17 nations comprising the Organization for European Economic Cooperation and also from Canada and Israel. The primary purpose of the Paris meeting was to assist the European participants in their current and projected nuclear power and research programs.

The agenda provided for a review of practices of fuel-element fabrication and of the behavior of fuel elements in reactor operation. Major topics included the manufacture of various types of elements, corrosion and irradiation problems, and recent advances in applied metallurgical research. All conference papers are unclassified; the proceedings will represent a compilation of the latest data and experience in fuel element technology.

### NSF Report on Research by Agricultural Experiment Stations

The National Science Foundation reports that expenditures for research by agricultural experiment stations increased tenfold from \$7 million in 1920 to more than \$74 million in 1953-54—\$17 million for basic research and \$57 million for applied research. Research funds for the stations came, for the most part, from the state governments and supplemented the core of support provided by the Federal Government. The states accounted for \$45 million; the Federal Government for \$13.5 million; and other sources, such as sales and royalties, for \$16 million. These findings are from an NSF survey of 53 agricultural experiment stations and are contained in a recent bulletin entitled "Funds for Research in Agricultural Ex-

periment Stations, 1953-54," No. 8 in the series *Reviews of Data on Research and Development*.

The 53 stations, practically all administered by the land-grant colleges and universities, are the fountainhead of this country's agricultural research. The largest amounts were devoted to animal production and field crops; the smallest, to genetics and farm forestry.

The stations accounted for 55 percent of the \$134 million research budget of the associated land-grant colleges and universities. As determined from the 41 stations that reported on faculty, the stations employed 45 percent of the total faculty engaged in research, or, in terms of full-time equivalents, 56 percent. Copies of the report may be obtained by writing to the National Science Foundation, Washington 25, D.C.

### News Briefs

A committee of the faculty of the department of biology, University of Notre Dame, will edit *The American Midland Naturalist*. George R. Bernard has been appointed chairman of the editorial committee.

\* \* \*

The National Committee on Aging of the National Social Welfare Assembly has announced that it will make a study to find out how the United States can insure the best use of the later years of its scientists. The study also will determine how retirement policies affect scientists. The 2-year project will be financed by a grant from the Dorr Foundation and will be directed by Edward N. Saveth, a social scientist and writer.

\* \* \*

The National Health Council has established a special fund in honor of the late Alan Gregg, formerly vice-president of the Rockefeller Foundation and a valued adviser to the council. Contributions to the Alan Gregg Fund will be used to support the council's Health Careers Program, designed to help meet the acute shortage of qualified health personnel in the United States.

\* \* \*

The Foundations' Fund for Research in Psychiatry has announced that 1 February 1958 is the next deadline for the submission of applications for research fellowships in psychiatry, psychology, sociology, neurophysiology, and other sciences relevant to mental health. Interested persons and departments are invited to write for details to: Foundations' Fund for Research in Psychiatry, 251 Edwards St., New Haven 11, Conn.

\* \* \*

The Public Health Service has announced that reported new cases of syphilis increased by 7.1 percent during



1956, reversing a downward trend that had been recorded each year since 1946. There were 131,763 cases of syphilis in all stages reported in the continental United States last year, compared with 123,044 in 1955. The 1947 total was 355,592.

\* \* \*

The Marine Biological Laboratory, Woods Hole, Mass., is offering a training program in neurophysiology under the direction of S. W. Kuffler, C. L. Prosser, and J. M. Tobias. Financial aid will be provided to nine pre- and post-doctoral fellows between 15 June and 31 August 1958. Applications should be made to the director of the laboratory not later than 1 January 1958.

### Scientists in the News

Primary responsibility for planning and directing United States technical participation in the second International Conference on the Peaceful Uses of Atomic Energy at Geneva, Switzerland, 1-13 September 1958, has been assigned by the Department of State to the U.S. Atomic Energy Commission. The commission has established a special office to carry out this responsibility. EDWARD R. GARDNER, director of the AEC's Office of Special Projects, has been appointed executive director of the new office, and L. D. PERCIVAL KING is on loan to the AEC from the University of California's Los Alamos Scientific Laboratory to serve as technical director.

ALBERT SCHWEITZER has received the newly established peace prize of the Bavarian Association of War Victims, Munich, Germany. He was given the \$2300 award for his achievements in bringing about "peaceful coexistence among men."

Seven physicists from outside the U.S.S.R. participated in the Soviet Conference on Nuclear Reactions in Moscow, 19-27 November. They were: HENRY H. BARSCHALL of the University of Wisconsin; RICHARD F. TASCHEK of the University of California and Los Alamos; M. DEUTSCH of Massachusetts Institute of Technology; L. KATZ of Canada; D. WILKINSON and J. H. BREMLIN of England; and S. A. E. JOHANSSON of Sweden.

EMERY A. ROVENSTINE, chairman of the department of anesthesiology at New York University's College of Medicine, has been awarded the Distinguished Service Award of the American Society of Anesthesiologists. Rovenstine is the director of anesthesia at Bellevue Hospital, Gouverneur Hospital, and Goldwater Memorial Hospital.

Two new members have been appointed to the department of psychology at the University of California, Berkeley. They are JACK BLOCK, associate professor, formerly associate research psychologist at the Institute of Personality Assessment and Research, Berkeley, and RICHARD S. LAZARUS, associate professor, formerly associate professor at Clark University.

The department also reports several visiting appointments for the present academic year: FLOYD H. ALLPORT, professor emeritus at the University of Oregon; and FRED ATTNEAVE and DANIEL E. BERLYNE, both of whom spent last year at the Center for Advanced Research in the Behavioral Sciences, Palo Alto. In addition, ARTHUR A. LUMSDAINE will hold a visiting appointment during the spring semester, 1958. Lumsdaine is chief of the Flight Systems Branch and the Training Branch, Air Force Personnel and Training Research Center, Lowry Air Force Base.

COUNT D. GIBSON, Jr., associate professor of medicine at the Medical College of Virginia, has been named professor of preventive medicine at the Tufts University School of Medicine, effective in January 1958. He succeeds DWIGHT O'HARA, who has retired.

ROBERT ELY, associate professor of pediatrics at the University of Utah College of Medicine, has received the \$1000 Ross Award for Pediatric Research of the Western Society for Pediatric Research. Ely's prize-winning work dealt with corticosterone metabolism in rheumatic fever.

CHARLES N. KIMBERLIN, Jr., assistant director of the Esso Research Laboratories, Baton Rouge, La., has won the 1957 Southern Chemist Award of the American Chemical Society's Memphis Section. The medalist was chosen "in recognition of 24 years' outstanding research in the fields of catalysis and petroleum chemistry."

WILLIAM J. KROLL, consulting electrochemist and metallurgist of Corvallis, Ore., and developer of the basic Kroll process used for producing metallic titanium and zirconium, has been chosen to receive the 1958 Perkin Medal of the American Section of the Society of Chemical Industry. Presentation of the medal to Kroll is scheduled to follow a dinner in his honor to be held at the Waldorf-Astoria, New York, on 10 January 1958.

JAMES CUFFEY of the Indiana University astronomy department has been appointed assistant director of the

university's Goethe Link Observatory, which is located 24 miles southwest of Indianapolis.

ALBERT G. WILSON, formerly director of the Lowell Observatory, has joined The Rand Corporation, Santa Monica, Calif., as a member of the senior staff in geophysics. He will be concerned with general problems of space flight and space physics.

### Recent Deaths

ASADOUR ALTOUNIAN, Newark, N.J.; 72; physician and medical pioneer in Asia Minor; 15 November.

CLARENCE G. BANDLER, New York, N.Y.; 77; urologist and former professor and chairman of the department of urology at the New York Post-Graduate Medical School; 15 November.

DWIGHT F. BARNES, Fresno, Calif.; 67; economic entomologist and specialist in dried-fruit insects for the U.S. Department of Agriculture; 11 October.

JOHN M. BURNHAM, New Haven, Conn.; 40; design manager of the Electric Boat Division of the General Dynamics Corporation, Groton, Conn.; responsible for the design of the nuclear submarines *Nautilus*, *Seawolf*, and *Skate*; 15 November.

ANNETTE GARRETT, Northampton, Mass.; 59; associate director of the Smith College School for Social Work for 22 years; 17 November.

RAY E. HEIKS, Columbus, Ohio; 42; research chemist for Batelle Memorial Institute; 31 October.

JAY McLEAN, Savannah, Ga.; 67; director of the Savannah Tumor Clinic and discoverer of heparin; former associate professor of research surgery at Ohio State University Medical College and director of the Bureau of Cancer Control, District of Columbia Health Department; 15 November.

SAMUEL PEARSON, Plainfield, N.J.; 72; meteorologist and amateur observer for the U.S. Weather Bureau; 19 November.

E. ALEXANDER POWELL, Canaan, Conn.; 78; explorer, lecturer, and author; former member of the Consular Service and a former war correspondent; 13 November.

JOHN W. ROBERTS, Winter Park, Fla.; 75; plant pathologist, formerly project leader in the U.S. Bureau of Plant Industry; specialist in the fungus, bacterial, and deficiency diseases of deciduous fruit trees and fruits, and also a specialist in fungicides; 15 November.

ALBERTO VILLAMIL, Buenos Aires, Argentina; cardiologist and president of the Argentine Cardiology Society; 18 November.

## Reports

### Selective Gametocide Opens Way to Hybrid Cotton

As shown in a review by Loden and Richmond (1), significant increases in most plant characters and in the yields of cotton have been found to result from heterosis in interspecific, intervarietal, and intravarietal crosses. Peebles (2) obtained a 25.5 percent increase in yield over the best parent in a first-generation hybrid between two American-Egyptian cottons. When he planted a 50/50 mixture of the hybrid and the best parent seed, the gain in yield was 18.5 percent rather than the expected 12.75; Peebles attributed this to more rapid seedling development and to subsequent dominance of the hybrid plants in the field. Kearney (3) illustrated the high fertility and fine appearance of  $F_1$  hybrids of Holden upland  $\times$  Pima Egyptian. This cross produced large bolls and exceptionally long and uniform fibers; Kearney noted that such a cotton would have surpassing agricultural and commercial value.

First generation crosses between Sea Island and upland cottons are of similar excellence but, as in the foregoing, efforts to combine and stabilize in a new variety the many desirable characters of the  $F_1$  hybrids have never been successful. Notable advantages in yield are commonly lacking (4) in hybrids of the superior upland cottons of the Southeast. On the other hand, promising results not only in yield but in fiber properties have been experienced from divergent upland crosses such as that between early and late strains and that between some southwestern and the southeastern upland varieties.

Male-sterile strains of cotton have been

sought unsuccessfully for many years, for they would provide opportunity for the controlled production of hybrid planting seed. Consideration even has been given (1) to the practicability of planting parent varieties in alternate rows and introducing heavy populations of bees to promote a measure of cross-pollination. Breeders and geneticists recognize that, with the achievement of a good method for producing hybrid cottonseed, there would follow an intensity of interest in evaluations of the combining abilities of world cottons which would parallel or exceed the activities that occurred with the development of the double-cross procedure for hybrid corn.

In the greenhouse (5) in the winter, Empire cotton plants were found to produce no pollen after they had been sprayed once with a 1.2 percent solution of sodium  $\alpha,\beta$ -dichloroisobutyrate (6). Over the 5-week period of observation, during which the plants quadrupled in size, many new branches were produced that bore flowers. When these flowers were hand-pollinated (few pollinating insects are present in greenhouses) with pollen from untreated plants, normal bolls with viable seed were developed. When not hand-pollinated, the young bolls were shed. By these observations it was indicated that the sodium salt of this chlorinated organic acid is freely absorbed by cotton plants and remains active and mobile for a long time. There was a passing toxicity from the spray in the form of patches of burned tissue followed by a chlorotic buckling of the mesophyll of expanding leaves. Some of the floral buds were shed. Terminal buds, when saturated, were killed, but new vegetative branches developed promptly.

To carry further the observations of male-sterile plants with additional cottons under field conditions, an experimental planting was made in plot S-3-L at the Citrus Experiment Station of the University of California in late May 1956. Two American-Egyptian cottons and two upland varieties were used. The four varieties were planted in 40-foot rows between alternating rows of a red-leaf cotton; in addition, there were 10-foot row segments of the red cotton at

the ends of the green rows. The red-leaf character is dominant over green. When ovules of green-leaf varieties are fertilized with red-leaf pollen, the resulting seedlings have red hypocotyls and cotyledons when they are exposed to bright light.

The four green-leafed varieties were sprayed with a 1 percent solution of the sodium  $\alpha,\beta$ -dichloroisobutyrate on 24 July, about 1 week before the first flowers appeared. It rained or drizzled nearly all of the next morning. Since it was not known whether a part of the material might have been washed off, the plants were again sprayed, but with a 0.5 percent solution, on the morning of 26 July.

Starting about 2 weeks after the first bolls had opened, the green-leafed cottons were picked three times at biweekly intervals. The seed from these pickings, when planted in greenhouse trays, gave seedlings with red hypocotyls in the percentages shown in Table 1.

Strain Acala 4-42 produced more green- than red-leaf seedlings, which indicated that the compound could not have effected extensive male-sterility in it. With pollen from the green-leaf Acala available in the small planting, it could not be expected that the seedlings from the remaining three varieties would all be red. The values found gave assurance, nevertheless, that a useful degree of male sterility was produced in the Empire, Amsak, and Pima cottons. As is mentioned below, the finding of varieties with high thresholds can be a distinct asset in the production of hybrid seed.

The germination of the seed picked from the inbred and weak Amsak plants was about 35 percent, but that from the other three varieties was 85 percent or better.

The cotton plants in the field were sprayed when they were 15 to 20 inches tall, while it was possible to apply the material to the desired rows without wetting the intervening male-parent rows. Such a plan would probably be followed in the production of hybrid cottonseed. Good coverage of the upper surfaces of the leaves of preflower plants with 1 percent solution used 1 oz. of the dry material per 100 feet of row. Spraying alternate rows in this manner would require about 4 lb of the material dissolved in 50 gal of water per acre.

With the foregoing promise of a practical means of producing hybrid cottonseed, the work was extended to additional greenhouse and field tests with new varieties and with salts of additional chlorinated organic acids as prepared by Rohm and Haas. Between compounds and their dosages, varietal variations have been found in the extent of the initial leaf burning and in the subsequent chlorotic buckling of the mesophyll, in

All technical papers and comments on them are published in this section. Manuscripts should be typed double-spaced and be submitted in duplicate. In length, they should be limited to the equivalent of 1200 words; this includes the space occupied by illustrative or tabular material, references and notes, and the author(s)' name(s) and affiliation(s). Illustrative material should be limited to one table or one figure. All explanatory notes, including acknowledgments and authorization for publication, and literature references are to be numbered consecutively, keyed into the text proper, and placed at the end of the article under the heading "References and Notes." For fuller details see "Suggestions to Contributors" in *Science* 123, 16 (4 Jan. 1957).

Table 1. Percentages of cotton seedlings with red hypocotyls produced from seed obtained at three pickings made at bi-weekly intervals.

Variety	Picking		
	1	2	3
<i>Upland cotton</i>			
Empire	75	77	62
Acala 4-42	33	40	33
<i>American-Egyptian cotton</i>			
Amsak F <sub>15</sub>	88	77	85
Pima S-1	75	78	66

the extent of bud shedding and the consequent delay of flowering, in the duration and regularity of pollen suppression, and in the promptness of the male-sterility response. The presence of pollen, even when the anther opening appears normal, has been found to be an uncertain criterion of pollen viability. Anthers of treated plants sometimes remain unopened in the forenoon but shed pollen in the afternoon. One of the compounds suppressed the pollen of one of the varieties into the ninth week but that of another only for a short period. A measure of response has been obtained by applying several of the materials to the soil. Wetting agents have been tried in some tests, but they appear to hasten absorption and increase burning.

In searching for means of reducing toxicity and extending the male-sterile reaction, the idea is now prominent that a first and second spraying with lower dosages would be effective. A second spraying could be carried out if the rows were spaced further apart than is practiced in commercial cotton production. Where there is a substantial difference in the threshold concentrations of the desired parents, several field-wide sprayings become possible if the most reactive variety is used as the female parent and the less reactive variety as the male parent.

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5. The initial greenhouse tests reported in this paper were made by me as part of cooperative investigations between the Field Crops Research Branch, Agricultural Research Service, U.S. Department of Agriculture, and the Texas Agricultural Experiment Station, College Station, Tex.
6. The sodium  $\alpha,\beta$ -dichloroisobutyrate was received from Rohm and Haas Company in 1955.

9 September 1957

## Alkaline Denaturation of Hemoglobin of Postlarval and Adult *Scorpaenichthys marmoratus*

The hemoglobin of the bullfrog tadpole is different from that of the adult (1). Since the teleost fish *Scorpaenichthys marmoratus* undergoes an extensive postlarval metamorphosis (2), an investigation of the alkaline denaturation of the hemoglobin of three adult and nine postlarval specimens of this fish has been undertaken in order to find out whether an ontogenetic change in the hemoglobin is associated with the metamorphosis (3). The rate at which oxyhemoglobin is converted to alkaline methemochromogen through denaturation at pH 11 to 13 has been a standard technique in the differentiation of adult and fetal mammalian hemoglobins (4, 5).

Adults and postlarvae were bled from the heart into heparinized Ringer's solution (6); the erythrocytes were washed three times in an excess of nonheparinized Ringer's solution. Centrifugally packed erythrocytes were lysed in distilled water (9 volumes of water to 1 volume of cells). Stromata were removed by prolonged centrifugation. The preparation of the hemoglobin was done at 0° to 1°C. No bloods were pooled. The hemoglobin solutions were used immediately for alkaline denaturation in sodium phosphate buffer (pH 11.0 to 12.0;  $\Gamma/2$ , 3.0), the reaction being followed spectrophotometrically (7).

Some of the results obtained at pH 11.0 are shown in Fig. 1. Similarly to the hemoglobin in several mammals—but not in man (4, 5)—*Scorpaenichthys*

postlarval hemoglobin has an initial alkaline labile component that denatures faster than that of the adult hemoglobin. In addition, the diphasic nature of the alkaline denaturation curve is more obvious in the case of postlarval hemoglobin. The relative proportions of fast- and slow-denaturing components vary in postlarval hemoglobin much more so than in adult hemoglobin; similar variation has been described by others for human adult hemoglobin (5, 8). The difference in alkaline denaturation between adult and postlarval *Scorpaenichthys* hemoglobins was consistently observed at both pH 11.0 and 12.0. Hence, there is a change in the biochemical nature of the hemoglobin in the development of *Scorpaenichthys* as in mammals (5, 9), the chicken (10), the terrapin (11), and the bullfrog (1).

In general, the oxygen tensions to which adult fishes and their pelagic young are subjected are approximately the same (150 mm-Hg)—a situation in contrast to that observed for most other vertebrate embryos and fetuses. Therefore, at present, a particular physiologically significant role cannot be assigned to the equivalent of a fetal hemoglobin in *Scorpaenichthys*. The occurrence of a distinct postlarval hemoglobin in *Scorpaenichthys* may represent the chance evolutionary development of a biochemical feature of little selective value. In fact, some larval and postlarval fishes—for example, the leptocephalus of the eel (12)—lack hemoglobin. Preliminary experiments on alkaline denaturation indicate the presence of a fetal hemoglobin in the live-bearing surf-perch *Embiotoca*

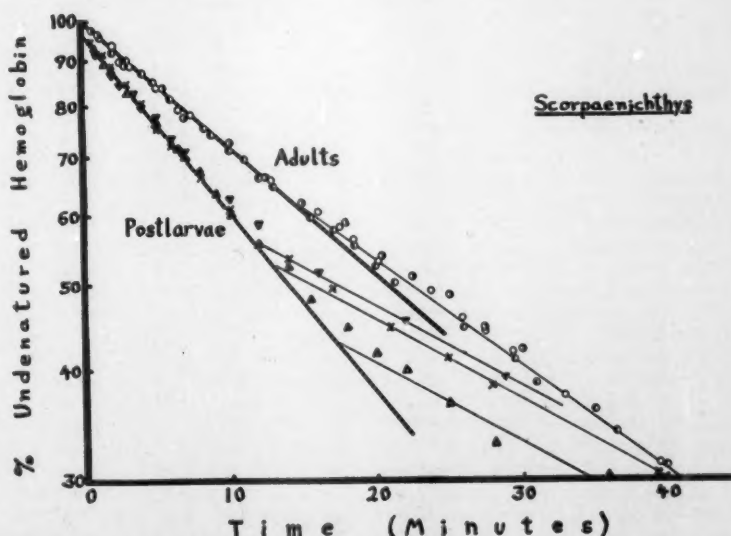


Fig. 1. Alkaline denaturation of the hemoglobin of three adult and three postlarval *Scorpaenichthys marmoratus* (pH 11.0;  $\Gamma/2$ , 3.0; 24°C).



*lateralis*; certainly in this viviparous fish it would be reasonable to assume that the function of a fetal hemoglobin would be the same as that accepted for the fetal hemoglobins of mammals (9).

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### Effect of Digestion on Distribution of Blood Flow in the Rat

The belief that splanchnic blood flow increases at the expense of flow in other organs during digestion was challenged by Herrick *et al.* (1) in 1934. By use of thermistromuhrs, dogs were found to show similar increases in carotid, femoral, and superior mesenteric arterial blood flow postprandially. Abramson and Fierst (2) found that the blood flow to the human hand, forearm, and leg tended to increase after eating. A meal increases the splanchnic blood flow of a human subject (3). However, the cardiac output also increases (4). When the experimental values are adjusted for surface area, it is found that the absolute postprandial increase in splanchnic blood flow in a 1.73 m<sup>2</sup> man is about 710 ml/min. A 24 percent increase in the cardiac output of such a man (5) represents 1300 to 1400 ml/min. From this it may

be concluded that the nonsplanchnic blood flow is increased by digestion.

The subject has been reinvestigated (6) with the aid of a newly developed method (7). The method is based on the observation that all organs other than the brain have, during the first minute after a single intravenous injection of K<sup>42</sup>Cl, substantially the same extraction ratios for K<sup>42</sup>. The fractional distribution of K<sup>42</sup> among the organs during the first minute therefore corresponds to the fractional distribution of the cardiac output. The anomalous behavior of the brain has been shown to be of minor consequence in the measurements of the blood flow to other organs. Values obtained by this method describe the fractions of the cardiac output directed to each organ. A knowledge of the cardiac output permits the calculation of the blood flow to each organ.

One hundred and seventeen rats were used. Control animals were starved for 24 to 72 hours but were permitted to drink water *ad libitum*. "Fed" animals were allowed to eat and drink *ad libitum* up to the time of the experiment. The gastrointestinal tract of the "fed" animals always contained 10 to 15 g of food at autopsy. The animals were anesthetized with Nembutal (40 mg/kg intraperitoneally). The cardiac output was determined by dye dilution, with Evans blue as the indicator; the blood was sampled at a rate of 90 collections per minute (8). Other similarly treated animals of the same stock were used for the fractional distribution studies with K<sup>42</sup>; the details of the method have been described previously (7).

The cardiac output of 17 control animals averaged 172 ± 38 ml/kg min. Eleven fed animals had a cardiac output of 223 ± 59 ml/kg min. Determinations of fractional distribution were made on 49 control and 40 fed animals. The fractions found for each organ were multiplied by the cardiac output value in animals of the same group (adjusted for body weight) to give blood flow values to the various organs.

Table 1 shows the blood flow values obtained in the organs of the two groups. For simplicity all values have been adjusted for the body weight and are presented as the blood flow to the organs of a 250-g rat.

It is clear from these results that, during digestion, there is a uniform increase in the blood flow to all organs of the rat. The splanchnic organs do not gain their increased blood supply at the expense of the blood supply to other organs; on the contrary, all organs benefit from the increased cardiac output associated with digestion.

These results, though obtained in anesthetized rats, are similar to those reported in conscious dogs and men; they

Table 1. Blood flow values in fasting and fed rats (all values have been adjusted to 250-g rats; blood flow is given in milliliters per minute).

Organ	Blood flow	
	Fasted	Fed
Liver (arterial)	3.2	4.3
Gut and spleen	7.1	9.4
Myocardium	1.1	1.3
Skin	3.2	4.2
Kidneys	6.6	8.7
Carcass	21.8	27.9

do not conflict with any reported findings. In the absence of contrary evidence, it is suggested that the prevailing concept that digestion results in diversion of blood flow from other organs to the digestive tract be critically re-examined.

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### Activation of Enzymatic Hydrolysis of Benzoylcholine by Tryptamine

During an investigation of the anticholinesterase activity of indole derivatives (1) it was found that tryptamine accelerates the enzymatic hydrolysis of benzoylcholine by plasma cholinesterase (2). It has also been reported that analogues (3) and other compounds (4) activate plasma cholinesterase, and in certain cases, red cell cholinesterase (5). Some authors attributed this activation to an interference with the partial inhibition of the enzyme (E) by the excess



substrate (S) molecules at high substrate concentrations (6). In agreement with this, Kalow (7) found that benzoylcholine inhibits plasma cholinesterase at high concentrations. He obtained optimal activity with benzoylcholine concentrations of about  $10^{-4}M$ . On the other hand, Hardegg and Schaeffer (8) assumed that cholinesterase is partially inhibited by the substrate at all concentrations. It seemed worth while to investigate whether the activation of plasma cholinesterase by tryptamine was due to the prevention of the combination of enzyme-substrate complex with a second molecule at higher than the optimum substrate concentrations or whether the activation resulted from a competition between the substrate and the activator for the active site of the enzyme at all concentrations.

In the present experiments, the hydrolysis of benzoylcholine by concentrated, purified, human plasma cholinesterase (Cholase, 9) was investigated by two different methods. With relatively low initial concentrations of benzoylcholine ( $5.10^{-5}M$ ), Kalow's ultraviolet spectrophotometric method was employed (10). With concentrations of  $2.10^{-3}M$  or higher, Ammon's modification of Warburg's manometric technique was applied (11). All experiments were carried out at pH 7.4 and  $37^{\circ}C$ . The spectrophotometric determination of the hydrolysis of benzoylcholine was made at 240 m $\mu$ . In these studies: the plasma cholinesterase activity was accelerated 62 percent when the tryptamine concentration was  $2.10^{-4}M$ . Because of optical reasons, higher tryptamine concentrations could not be used. In the manometric experiments, when the concentrations of benzoylcholine and tryptamine were  $2.10^{-3}M$ , the activation was 83 percent. In the Warburg studies, a fourfold change in the enzyme concentration (from 1/8000 to 1/2000 by volume) had little effect on the acceleration of hydrolysis of  $5.10^{-5}M$  benzoylcholine caused by  $2.10^{-3}M$  tryptamine. The increase in activity in the presence of the highest and the lowest enzyme concentrations was 51 and 62 percent, respectively.

The effect of other indole derivatives on the hydrolysis of benzoylcholine by plasma cholinesterase was also investigated. Those compounds, which had an OH group attached to the indole nucleus or a carboxyl or a dimethyl group substituted in the side chain, or both (for example, 5-hydroxytryptamine, tryptophan, 5-hydroxytryptophan, dimethyltryptamine, gramine, or bufotenine) did not activate plasma cholinesterase. Some of these compounds inhibited the enzyme (12). The hydrolysis of other substrates (for example, acetylcholine, butyrylcholine, procaine, and murexine) by plasma cholinesterase was not accelerated

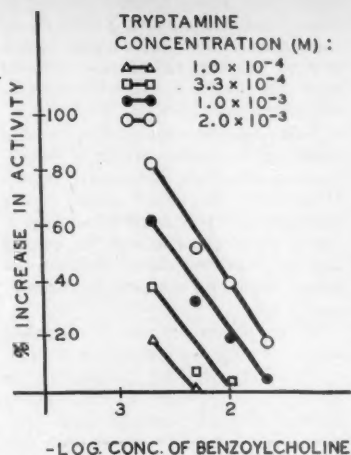


Fig. 1. Effect of increasing the substrate concentration on the acceleration of benzoylcholine hydrolysis by tryptamine.

ated but inhibited by tryptamine. Some of these substrates, similarly to benzoylcholine, have a low ( $\approx 10^{-6}M$ ), and others (for example, acetylcholine and butyrylcholine) a high ( $\approx 10^{-3}M$ ), Michaelis constant ( $K_m$ ). Consequently, it is unlikely that the hydrolysis of benzoylcholine was accelerated because of its low  $K_m$ . It is of interest that the enzymatic breakdown of PDMI-669 (the triethyl derivative of PDMI-669) was neither accelerated nor inhibited by tryptamine. The hydrolysis of acetylcholine by red cell cholinesterase was also inhibited by tryptamine.

It has been suggested that excess substrate inhibits the enzymatic hydrolysis by the attachment of a second substrate molecule to the enzyme with the formation of an E.S.S. complex (13). Since it was found that tryptamine also accelerated the hydrolysis of benzoylcholine at suboptimal substrate concentrations ( $5.10^{-5}M$ ), where the formation of an E.S.S. complex is unlikely to occur, it is therefore not probable that the activating effect of tryptamine is due to the prevention of the formation of this complex. It is also conceivable that the accelerating effect of tryptamine might be caused by the formation of a complex of tryptamine and benzoylcholine. This would decrease the concentration of excess substrate and would interfere with its inhibitory effect. Because tryptamine also activates at suboptimal substrate concentrations, where the binding of benzoylcholine by tryptamine would decrease the rate of enzymatic hydrolysis, this hypothesis is not likely to be correct. A further argument against the above assumption is that, while there is less than 10 percent increase in the rate of enzymatic hydrolysis of benzoylcholine,

when the substrate concentration is decreased from  $10^{-2}$  to  $10^{-3}M$  (7), more than 20 percent acceleration could be obtained at these substrate concentrations by tryptamine (see Fig. 1). Finally, there was no change in the ultraviolet absorption spectrum of a  $5.10^{-5}M$  benzoylcholine solution after the addition of  $10^{-4}M$  tryptamine. A more likely explanation of the accelerating effect of tryptamine is that, in its absence, the quaternary N of benzoylcholine may be attached to the anionic site of the enzyme in such a way that the resulting configuration is unfavorable for the reaction between its ester group and the esteratic site of the enzyme. Tryptamine, which is a cation at pH 7.4, may compete with benzoylcholine for the anionic site and thereby facilitate the attachment of benzoylcholine to the functionally important esteratic site. The curve obtained by plotting the increase in activity caused by various tryptamine concentrations against the negative logarithm of substrate concentrations (see Fig. 1) indicates that the acceleration is indeed a competitive process. The rate of hydrolysis increased with decreasing concentrations of benzoylcholine or with increasing concentrations of tryptamine. Preliminary studies with other pharmacologically active cations seem to corroborate this hypothesis (2).

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2 August 1957

## Role of Polyphenolase in Streptomycin-Induced Resistance to Phytophthora in Potato

Some information has been obtained about the biochemical mechanisms of resistance to plant diseases from study of the potato, *Phytophthora infestans* de By. complex. Rubin and co-workers (1) and the Göttingen school (2) succeeded in demonstrating that the activation of polyphenolases (tyrosinase) at the site of infection may lead to the accumulation of polyphenol derivatives. The increase in these highly fungitoxic substances being more intense in resistant than in susceptible varieties, their accumulation may be regarded as an important factor contributing to disease resistance.

Recently Müller *et al.* (3) were able to show that, if streptomycin is absorbed by potato or tomato plants through their

roots, these plants become resistant to *Phytophthora*. The effect is indirect, for the fungus is known to be highly insensitive to streptomycin *in vitro*. Similar data that pertain to other host-parasite complexes have been described (4).

This study was undertaken to shed some light on the mechanism of streptomycin action. As is shown, streptomycin absorbed by the potato tissues greatly enhances their polyphenolase activity. It seems, therefore, that both the natural and streptomycin-induced resistance of potato depend on the same biochemical mechanism.

Whole potato sprouts or detached leaves, or both, were placed in streptomycin sulfate solutions (100 ppm in tap water). Controls were treated similarly but were placed in pure tap water. Samples were taken for the assays every two days for a week. The leaves used for the experiments were cut into halves. One half was used for the determination of polyphenolase activity and the other for the assay of the streptomycin content. Enzyme activity was measured in homogenates by the use of conventional manometric procedures. Catalytic amounts of catechol were used as substrate, and hydroquinone was chosen as a suitable reductant (5). Streptomycin was assayed according to the method of Pramer (6), with *Bacillus subtilis* as a test organism.

In several consecutive experiments, 20 assays of polyphenolase activity were carried out; as a result of treatment with streptomycin, strong stimulation was found in each case (30 to 110 percent). Slight stimulation was found in the early stages of treatment, when streptomycin was present only in traces in the tissues. Higher streptomycin content was generally correlated with higher polyphenolase activity. Representative data are shown in Table 1. Autooxidation and trace-element catalysis of substrates was estimated by use of boiled controls. The data in the tables have been corrected for autooxidation values.

The effect of streptomycin on the tissues of tubers is very similar. Small disks (5 mm in diameter) of cortex tissues were placed in streptomycin solution or in water. The polyphenolase activity was measured by adding the phenolic substrates from the side bulb to the disks that were suspended in buffer solution in the main compartment of Warburg vessels. As may be seen (Table 2), the respiration of streptomycin-treated disks was strongly decreased. Simultaneously, the polyphenolase activity was considerably enhanced. The activation of polyphenolases was shown also by the quick blackening of the treated disks, in contrast to the modest discoloration of the controls.

The effect of streptomycin is indirect, for the antibiotic was shown to be totally inactive when tried directly as a "sub-

strate" in the assay of polyphenolase activity.

The results reported provide strong evidence for the idea that streptomycin exerts its protective effect via the polyphenol-polyphenolase system of the host plant. Further support for the validity of this suggestion is delivered by the recent observation of McNew (7) which indicated a synergistic effect of copper and streptomycin. The relation of this finding to our results is evident: polyphenolases are copper enzymes, and their activity is greatly dependent on the copper supply of the plant.

Results similar to those described above were obtained with tomato plants.

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## Effect of Gibberellic Acid on Breaking of Rest Period in Elberta Peach

Gibberellic acid, which is produced from the fungus *Gibberella fujikuroi*, has been reported to exhibit profound growth-regulating properties when applied to plants. Rappaport found a 60-percent increase in fresh weight 10 days after an application of this material to the first expanded leaf of the young tomato plant (1). Kahn reported that gibberellic acid replaces the red light required for proper germination of lettuce seed (2). Harrington's investigations revealed that gibberellic acid induces flowering in nonvernalized endive plants (3).

The multitude of effects that gibberellic acid has induced in a number of plants led to our investigation, in which gibberellic acid was used as a chemical activator for breaking the rest period of the peach. The rest period, as referred to in this report, is a state of dormancy during which a plant will not produce visible growth even though environmental conditions are favorable. In order to overcome or "break" the rest period in peaches, a period of chilling is necessary. According to Weinberger, the chilling

Table 1. Polyphenolase activity and streptomycin content in potato leaves treated with streptomycin. Enzyme activity is expressed as the increase in oxygen uptake upon addition of substrates (0.02 percent catechol and 0.6 percent hydroquinone) in cubic millimeters of oxygen per milligram (fresh weight) of tissue homogenate, per hour.

Hours after treatment	Polyphenolase activity		Streptomycin content (µg/g fresh wt.)
	Control	Treated	
24	0.81	1.02	Traces
72	0.90	1.61	40

Table 2. Respiratory rate and polyphenolase activity in potato disks treated with streptomycin. Respiratory rate is expressed as cubic millimeters of oxygen per gram (fresh weight) per hour. Enzyme activity is expressed as increase in oxygen uptake in cubic millimeters under identical conditions upon addition of substrates.

Hours after treatment	Respiratory rate		Polyphenolase activity	
	Control	Treated	Control	Treated
3	68	65	28	30
24	64	40	32	102

period necessary for activation of vegetative growth in the Elberta peach is 950 hours of temperature below 45°F (4).

Two-year-old Elberta peach trees which had "normally" dropped their leaves in the fall and had been exposed to temperatures below 45°F for a maximum of 164 hours were transplanted from the orchard to large cans and placed in a storage room kept at 65°F. United States weather records, taken in the area, were used in calculating the number of hours in which the temperature was below 45°F. Lights were on in the room from 8 A.M. to 5 P.M. daily, and the trees were watered as necessary.

On 23 February 1957, 95 days after the trees had been placed in the storage room, 14 trees were placed in the greenhouse for treatment with gibberellic acid (5). The following concentrations of gibberellic acid were used: 0, 50, 100, 200, 500, 1000, and 4000 ppm. Solutions of each concentration were sprayed on two trees. Fourteen days later, at the time of the second application, it was noted that a large percentage of the buds on the trees that had received the 1000- and 4000-ppm applications had grown and produced small green leaves. Trees that had been sprayed with the lower concentrations (0, 50, 100, 200, and 500 ppm) did not show any growth at that time. On 29 March, after the trees had received two applications of gibberellic acid (23 February and 8 March), the trees that had been sprayed with 1000 and 4000 ppm were growing rapidly. The trees that had received 200 and 500 ppm were growing some, but trees that had been sprayed with concentrations lower than 200 ppm were still dormant (Table 1). The growth response of trees that had received the same treatment was uniform.

In another experiment, three trees that had been exposed for 433 hours to temperatures below 45°F, nearly half of the number of hours necessary to break the rest period, were sprayed with 0,

Table 1. Effect of gibberellic acid on the breaking of dormancy of buds of 2-year-old Elberta peach trees. The trees had been exposed to temperatures below 45°F for 164 hours before treatment. Data were recorded 29 March 1957, 36 days after the initial application of spray.

Gibberellic acid concn. (ppm)	Leaf buds growing		Av. growth per shoot (in.)
	(No.)	(%)	
0	0	0	0
50	0	0	0
100	0	0	0
200	17	40	0.25
500	17	50	0.5
1000	28	85	2
4000	37	98	4

Table 2. Effect of gibberellic acid on breaking the rest period in dormant peach seeds. Seeds received approximately one-half of normal stratification period before treatment. Data were recorded 16 days after the gibberellic acid treatment.

Gibberellic acid concn. (ppm)	Germination (%)
0	30
20	50
100	80
200	70
500	40
1000	30

100, and 200 ppm of gibberellic acid, respectively. The trees were sprayed four times at 10-day intervals. Four days after the first application it was noted that one or two buds on the tree that had received the 200 ppm spray were opening and exhibiting small leaves. Fifty days after the first application, the tree that had been treated with 200 ppm of gibberellic acid had an average of 14 inches of new terminal growth and large, "normal" green leaves. At the same time, buds on the tree that had been sprayed with 100 ppm had 3 to 4 inches of new growth, but there were still a few completely dormant buds. Two or three buds on the untreated control were just starting to "break" dormancy. Trees that have not been exposed to the necessary chilling period commonly have a few open terminal buds after a long period of favorable growing temperatures, but the growth is usually somewhat abnormal.

Tests were also conducted with peach seed that had received 35 days of stratification—that is, the seed were placed in a moist medium at a temperature near freezing. The standard time for stratification of peach seed is between 60 and 100 days at 41°F, according to Kains and McQuesten (6). In this experiment ten seeds were soaked for 24 hours in each of the following concentrations of gibberellic acid: 0, 20, 100, 200, 500, and 1000 ppm. The seeds were then planted in a flat of sand, and after 16 days the percentage germination was recorded (Table 2).

The percentage germination of seed that had been soaked in 100- or 200-ppm concentrations of gibberellic acid was greater than that of seed that had been soaked in other concentrations. Concentrations higher than 200 ppm may have been toxic for optimum germination and growth. Twenty days after the treated seed had been planted, the plants were measured. There was little root growth and no top growth of the plants grown from seed that had been treated with concentrations in excess of 200 ppm. The root and top growth of plants grown from seed that had been soaked in 20-

ppm concentration was greater than that of the untreated controls but smaller than that of plants grown from seed that had been soaked in the 100-ppm concentration. Plants grown from seed that had been soaked in the 100- and 200-ppm treatments averaged the same length and weight, although there was considerable variation within a treatment. The plants grown from seed that had been treated with 100 ppm were much larger, averaging 48 percent more top growth than the untreated control plants. Three plants that had received the same treatment and that had the same amount of top growth were selected for comparison of their root systems. The roots of plants grown from seed that had been treated with 100- and 200-ppm concentrations of gibberellic acid were much larger than the roots of the untreated controls. Seed that had been soaked in the 100 ppm solutions produced plants with root systems of 56 percent greater length and 80 percent greater weight (on a fresh-weight basis) than did the untreated seed.

Gibberellic acid apparently activates the metabolic processes or nullifies the effect of an inhibitor of growth of young Elberta peach trees. Thus gibberellic acid "replaced" the cold requirement for the breaking of the rest period in the young trees. If mature trees responded similarly, without a detrimental effect on other plant processes, southern peach growers would be able to grow varieties that required a longer chilling period. There also exists the possibility of extending the peach industry further south to new areas. Further investigations of the effect of gibberellic acid on the biochemical processes may help in understanding the rest period of plants.

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12 August 1957

#### Protection of Guinea Pigs Against Radiation Death by Cell-Free Mouse Spleen Extract

In previous studies it has been demonstrated that cell-free saline extracts of mouse spleens obtained from donor animals 6 days after their exposure to an LD 30/15 days contained a factor which protects mice against radiation-induced



Table 1. Summary of mortality data.

Time after exposure (days)	Expt. 1 (dose 550 r in air)		Expt. 2 (dose 600 r in air)		Expt. 1 + expt. 2	
	Animals alive (No.)	Mortality (%)	Animals alive (No.)	Mortality (%)	Total animals alive (No.)	Total mortality (%)
<i>A. Saline (0.4 ml)</i>						
0	40	0	20	0	60	0
5	40	0	20	0	60	0
10	38	5	20	0	58	3
15	30	25	13	35	43	28
20	28	30	12	40	40	33
<i>B. Spleen (0.4 ml)</i>						
0	30	0	30	0	60	0
5	30	0	30	0	60	0
10	30	0	30	0	60	0
15	26	13	28	7	54	10
20	26	13	28	7	54	10
<i>C. Spleen (0.2 ml)</i>						
0	10	0	20	0	30	0
5	10	0	20	0	30	0
10	10	0	19	5	29	3
15	7	30	14	30	21	30
20	7	30	14	30	21	30

mortality (1). This factor was also found in the spleens obtained from unirradiated donor animals (2) but was missing in extracts prepared from the spleens that had been removed 6 days after exposure of the donor mice to an LD 55/15 days (2).

We have now been able to demonstrate that such cell-free saline extracts protect not only mice but also guinea pigs against radiation-induced mortality (3).

The preparation of the mouse spleen extracts was essentially the same as has been previously described (2). Spleens were removed as quickly as possible from unirradiated donor mice that had been killed by cervical dislocation. The organs were frozen on Dry Ice, ground in a mortar, and extracted for at least 24 hours with saline (1 ml per spleen) at refrigerator temperature. The extracts were made cell-free by centrifugation and filtration through both a Seitz and a Selas porcelain filter (4). All these procedures took place at low temperatures. The filtrate was lyophilized.

For injection, the lyophilized material was dissolved in sterile saline so that 1 ml corresponded to the contents of five spleens (spleen extract). Amounts of 0.2 and 0.4 ml were injected intramuscularly each day, starting on zero day shortly after irradiation of the guinea pigs, for five consecutive days.

The guinea pigs from a highly inbred Rockefeller strain, bred at the Naval Medical Research Institute, were exposed in a large animal irradiator (5) to dosages of 550 and 600 r in air of  $\text{Co}^{60}$  gamma radiation with a 4  $\pi$  geometry in

groups of ten (6). Mortality was observed over a period of 20 days and compared with that produced in animals that had been subjected to the same amount of irradiation and that had received 0.4 ml of saline. The results are presented in Table 1.

As may be seen in Table 1, with each of the two radiation dosages, administration of 0.4 ml of spleen extract caused a reduction in radiation-induced mortality, while the injection of 0.2 ml of extract resulted in a mortality corresponding to that of the saline-injected control animals.

A statistical analysis of these data by chi square was made (7); this established the fact that the difference between group A (saline) and group B [spleen (0.4 ml)] was statistically not significant in experiment 1 ( $\chi^2$ , 0.8203) but was significant in experiment 2 ( $\chi^2$ , 4.7482). Since the statistical analysis also proved that neither the saline controls nor the spleen groups in experiments 1 and 2 were significantly different from each other ( $\chi^2$ , 0.256 and 0.186, respectively), a comparison of the combined mortality data for the two experiments for groups A and B was permissible. The combined data demonstrated a protective effect of spleen extract (0.4 ml), with a satisfactory statistical significance ( $\chi^2$ , 5.3788;  $P$ , 0.05 to 0.02).

The favorable effect of the spleen extract on mortality was also reflected in the weight curves (8).

As far as we know, the foregoing data represent the first observations of protection against radiation-induced mortality with a cell-free total spleen extract

obtained from heterologous material (9).

The importance of these observations consists in the following: (i) They give strong support to the theory that a humoral factor or factors of spleen (10) is the essential agent, in the protection against radiation-induced mortality, of spleen shielding, spleen transplantation, or spleen homogenates. (ii) They indicate that this agent is not a species-specific factor. (iii) They offer, therefore, a justified hope for the eventual identification and isolation of the protective factor.

Investigations along these lines are in progress.

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4. To prove that the filtration method used to make the extracts cell-free truly removed all cellular material, the following tests were performed. A pure strain of A.T.C.C. No. 4157 of *Escherichia coli* in brain-heart infusion broth was filtered after 48 hours' incubation, first through a Seitz, and then through a Selas, microporous filter (No. 03 porosity) under pressure. The filtrate was then streaked out on a blood-agar plate, and, in addition, a brain-heart infusion broth was inoculated. Both samples were found to be sterile at the end of a 72-hour incubation period.
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11 September 1957

#### Dietary Calcium Levels and Retention of Radiostrotrium in the Growing Rat

The contamination of dietary sources of calcium with radiostrotrium has led to a consideration of methods by which the absorption and retention of dietary radiostrotrium can be reduced. The data reported here do not imply that remedial measures are now necessary and do not evaluate the practical application of such methods. Previous work has been mainly



concerned with methods for removal of this radioisotope after acute or short-term exposure, and this work has been the subject of a recent symposium (1) and has been reviewed recently by Comar and Wasserman (2). The chronic ingestion of radiostrontium, as from fallout debris, represents a problem different from that of acute exposure.

Procedures usually visualized for minimizing the retention of continuously ingested radiostrontium involve the use of some dietary additive. Necessarily, any such alteration of the diet must not interfere with the over-all nutritional health of the individual. The most obvious approach is to supplement the diet with uncontaminated calcium, a physiological element, for the purpose of diluting ingested radiostrontium. However, data reported by MacDonald *et al.* (3) and by Wasserman *et al.* (4) have shown that increasing the calcium content of a single oral dose of radiostrontium by a factor of 10 to 1000 did not appreciably reduce the amount of radiostrontium absorbed and retained. The present study was therefore designed to learn whether radiostrontium intake and deposition are in fact governed by the calcium intake and whether, on a longer-term basis, supplementing the diet with uncontaminated calcium would quantitatively reduce the retention of ingested radiostrontium (5).

Thirty-two 5-week-old male rats of the Carworth strain, initially weighing 83 g, were divided into three groups according to body weight. The control group was given the basal diet containing 0.5 percent calcium supplied in the following forms: calcium naturally occurring in corn, brewers yeast, and so forth, 0.14 percent; as the biphosphate, 0.04 percent; as the carbonate, 0.09 percent; as the citrate, 0.23 percent. The other groups received this diet supplemented with  $\text{CaCO}_3$  to contain either 1.0 percent or 2.0 percent calcium; sufficient phosphorus (as  $\text{KH}_2\text{PO}_4$ ) was also added to maintain a Ca/P ratio of about 2/1. After either 8 days (period I) or 38 days (period II) on these diets, the drinking water of six rats from each group was replaced with distilled water containing about 20  $\mu\text{C}$  of  $\text{Ca}^{45}$  and 10  $\mu\text{C}$  of  $\text{Sr}^{85}$  per liter; both radioisotopes were employed as the chloride and were essentially carrier-free. The rats were continued on their respective diets, and the volume of water consumed over the next 7 days was estimated by use of graduated drinking tubes. All rats consumed about the same amount of water. Then at the 15th or 45th day after they had been on the diet, the rats were killed, and the  $\text{Ca}^{45}$  and  $\text{Sr}^{85}$  retained in the pelted, eviscerated carcasses were determined by the usual radiochemical procedures (6); the results are expressed as "percentage of ingested dose," but sample values are given in a footnote of

Table 1 to indicate the absolute retention of the  $\text{Sr}^{85}$ .

The pertinent data are summarized in Table 1. It may first be noted that the higher levels of dietary calcium did not greatly alter the total feed ingested, the body weight, or the ash content of the carcass at either time interval. However, it is apparent that, as the calcium level in the diet increased, the retention of  $\text{Sr}^{85}$ , as well as that of  $\text{Ca}^{45}$ , was reduced. In the 15-day groups (period I), a fourfold increase in calcium intake resulted in about a threefold decrease in radiostrontium retention; at 45 days (period II), this relationship was nearly proportional, for each twofold increase in calcium ingestion gave about a twofold depression in the retention of  $\text{Sr}^{85}$ . These differences would suggest that the rat requires more than 15 days and less than 45 days to adapt fully to the different levels of calcium intake.

The comparative effect of added calcium upon both  $\text{Ca}^{45}$  and  $\text{Sr}^{85}$  can be conveniently observed by the calculation of the "strontium-calcium observed ratio" (OR), which is defined as (7),

$$\text{OR}_{\text{carcass-diet}} = \frac{\text{Sr}^{85}/\text{Ca}^{45} \text{ in carcass}}{\text{Sr}^{85}/\text{Ca}^{45} \text{ in diet}}$$

It is first noted that the  $\text{OR}_{\text{carcass-diet}}$  values are about 0.23, which shows that the  $\text{Sr}^{85}$  was retained only 0.23 as effectively as the  $\text{Ca}^{45}$ ; this is in good agreement with previous findings (7, 8). The main point is, however, that the  $\text{OR}_{\text{carcass-diet}}$  values were essentially the same at each level of dietary calcium. This means that the added calcium influenced the absorption and retention of both  $\text{Sr}^{85}$  and  $\text{Ca}^{45}$  to about the same degree.

In an additional study, whole milk containing tracer amounts of  $\text{Ca}^{45}$  and  $\text{Sr}^{85}$  was supplemented with different levels of calcium gluconate, and rats were allowed to feed on it *ad libitum* for a period of 1 week. The  $\text{OR}_{\text{carcass-diet}}$  on the basal whole milk diet was found to be 0.62; when the milk contained either 50 percent, 100 percent, or 200 percent more calcium than the basal diet, the  $\text{OR}_{\text{carcass-diet}}$  values were 0.61, 0.61, and 0.59, respectively. The constancy of these observed ratios indicates, again, that dietary calcium affected both  $\text{Ca}^{45}$  and  $\text{Sr}^{85}$  to the same degree. It is noted that both the dietary vehicle and the calcium salt differed from the previous study in which calcium carbonate was used.

The data from the earlier single-dose studies can probably be accounted for by the fact that, on a short-term basis, the animal tends to absorb more calcium when the calcium level is suddenly raised; if the excessive intake of calcium were continued, it is expected that the animal would eventually revert to its previously established absolute utilization and retention. In addition, the retention of single dosages of radiocalcium and radiostrontium may be complicated by exchange reactions.

The question arises whether increasing the stable strontium concentration of the diet would proportionally decrease radiostrontium retention. In an experiment with rats, similar to those described before, it was found that a fourfold increase in the concentration of stable strontium in a milk diet did not reduce the absorption and retention of ingested radiostrontium. Thus, as expected, the response is related to the total stable calcium-stable strontium content of the diet and, there-

Table 1. Effect of dietary calcium levels on the retention of radiocalcium and radiostrontium in the rat. The basal diet consisted of 68.2 percent ground yellow corn, 19.1 percent vitamin-free casein, 5.7 percent brewers' yeast, 3.8 percent cottonseed oil, and 3.2 percent salt mixture U.S.P. XIV; this diet was supplemented with thiamine, riboflavin, pyridoxine, niacin, calcium pantothenate, choline, inositol, biotin, folic acid, vitamin B<sub>12</sub>, p-aminobenzoic acid, and vitamins A, D, and E at levels estimated to be optimal for the rat (the basal diet contained 0.5 percent calcium).

Level of dietary Ca (%)	Intake		Body wt. at death* (g)	Ash wt. of carcass* (g)	Amount retained in carcass (% of ingested dose)*		OR†
	Food (g)	Ca (g)			Ca <sup>45</sup>	Sr <sup>85</sup>	
Period I (15 days on diet)							
0.5	230	1.2	145 ± 12	3.4 ± 0.2	77.4 ± 1.5	19.3 ± 0.6	0.25
1.0	230	2.3	143 ± 6	3.5 ± 0.2	51.2 ± 1.2	10.5 ± 0.7	0.21
2.0	240	4.8	140 ± 3	3.3 ± 0.1	27.8 ± 1.4	6.5 ± 0.5	0.23
Period II (45 days on diet)							
0.5	690	3.5	261 ± 7	5.8 ± 0.3	63.0 ± 1.6	17.7 ± 1.1‡	0.28
1.0	680	6.8	266 ± 8	6.6 ± 0.2	32.3 ± 1.1	7.0 ± 0.3	0.22
2.0	730	14.6	261 ± 10	6.9 ± 0.4	18.3 ± 2.5	3.8 ± 0.4	0.21

\* Values are mean ± standard error of mean; six rats per group.

†  $\text{OR} = \text{OR}_{\text{carcass-diet}} = (\text{Sr}^{85}/\text{Ca}^{45} \text{ in carcass}) / (\text{Sr}^{85}/\text{Ca}^{45} \text{ in diet})$ .

‡ The following figures indicate the absolute levels in this study: about 4  $\mu\text{C}$  of  $\text{Sr}^{85}$  was ingested per rat, and the amounts retained at the 0.5-, 1.0- and 2.0-percent calcium levels were 0.72, 0.35 and 0.17  $\mu\text{C}$  of  $\text{Sr}^{85}$ , respectively.

fore, it is then more useful to focus attention on the more physiological element, calcium.

It may be pointed out that the increased dietary calcium levels in these studies caused a decrease in the total radiostrontium retention because (i) the stable calcium was an effective diluent for radiostrontium and (ii) the increased dietary calcium levels did not cause an increased growth of the skeleton. To produce a decreased concentration of radiostrontium per unit of bone, it is only necessary that the stable calcium effectively dilute the strontium. In summary, it has been shown that supplementary uncontaminated calcium in the diet of the rat will proportionally decrease the fractional retention of continuously ingested radiostrontium under the conditions of the present experiment. Further investigations must be made to determine whether these relationships hold over broader ranges of variables that may be involved and to explore the general applicability of the present findings in the rat to man and other species.

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31 October 1957

### Inhibition of Plant Growth by Root-Drench Applications of Kinetin

The announcement of the isolation of kinetin (6-furfurylaminopurine) and of its stimulation of cell division in tobacco callus tissue (1, 2) has led to a search by many investigators for other types of biological activity of this compound. The effects of kinetin reported to date include

substitution for red light in promoting expansion of bean leaves and germination of lettuce seed (3), prevention of protein degradation in detached *Xanthium* leaves (4), stimulation of elongation of *Avena* coleoptiles (5), and inhibition of regeneration of tentacles of *Hydra* (6). Inhibition of root development by kinetin has been reported by several workers, including Miller (2), who stated that the root growth of lettuce seedlings was inhibited severely when the seeds were treated with kinetin. There have been no reports of inhibition of growth with kinetin when intact plants grown to maturity were used. This paper reports such an inhibition (7). Our studies were conducted during November and December 1956 in a greenhouse with a temperature range of 72° to 80°F. Twenty-one-day-old seedlings of tomato, variety Bonnie Best, growing singly in sand in 5-inch clay pots were treated by adding aqueous solutions of kinetin to the surface of the sand. Fifty-milliliter portions of a 10-, 50-, or 100-ppm solution were applied to individual pots on the first, third, and fifth days of each week. On the intervening days, the plants were watered with nutrient solution. This schedule was continued for 4 weeks. It is noted that the limit of the water solubility of kinetin at room temperature is approximately 100 ppm. The average increase in height of the plants was used as an index of the over-all growth. The results are given in Table 1. It is apparent from this study that, as the dosage of kinetin was increased, the growth of the tomato plants was more strongly inhibited. Plants treated with 100 ppm of kinetin had small, atypically shaped leaves, drastically reduced root systems, and purple pigmentation similar in appearance to that associated with phosphorus deficiency. They often exhibited loss of turgor on warm days. The plants flowered approximately 2 weeks later than the control plants and produced flowers and fruit of reduced size. Although the fruit were small, seeds harvested from them were viable and produced normal seedlings.

The response of the plants treated with 50 ppm of kinetin was similar, but not so pronounced as that of plants treated with 100 ppm. The growth of plants treated with 10 ppm was significantly inhibited, but only slight indications of the other effects mentioned above were evident.

This experiment was repeated in all essential details, except that the tomato plants were grown in soil. The results are also given in Table 1. Comparatively slight inhibition of growth was obtained by treating tomato plants that were growing in soil. However, a slightly more spindly growth was evident in all treated plants. Several days' delay in flowering and slightly reduced root systems were

Table 1. Average increase in height of tomato plants growing in sand or soil treated with aqueous solutions of kinetin after 4 weeks of treatment. Fifteen plants were included for each treatment. The average initial height of plants grown in sand was 6.7 cm; that of plants grown in soil was 7.8 cm.

Concentration of kinetin* (ppm)	Average increase in height (cm)
<i>Plants grown in sand</i>	
0	20.2
10	12.5
50	5.2
100	3.4
L.S.D.*-0.01	2.1
L.S.D.*-0.05	1.6
<i>Plants grown in soil</i>	
0	23.9
10	18.6
50	16.0
100	17.2
L.S.D.*-0.01	3.5
L.S.D.*-0.05	2.8

\* Least significant difference.

observed in plants treated with 50 ppm and 100 ppm of kinetin.

The plants growing in soil treated with kinetin recovered—that is, they compared favorably in size with control plants—approximately 2 weeks after the treatments were discontinued. The plants grown in sand made only slight recovery, and this very slowly.

Inhibition of growth in height was observed in similar experiments in which seedlings of sunflower, bean, corn, and wheat were grown in sand. The response of the latter two species was evident only with the 100-ppm kinetin treatment, whereas the other species responded at lower concentrations. Inhibition of root growth was characteristic of all plants treated with the highest concentration.

Experiments now in progress indicate that a single watering with 100 ppm of kinetin significantly inhibits plants growing in sand. Spraying seedlings of several of the previously mentioned species to the point of run-off with aqueous solutions containing up to 100 ppm of kinetin produced no observable effects.

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#### References and Notes

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2. C. O. Miller et al., *ibid.* 77, 1392 (1955).
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5. R. S. Platt, Jr., in preparation.
6. R. G. Ham et al., *J. Am. Chem. Soc.* 78, 2648 (1956).
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26 August 1957

## Book Reviews

**L'Évolution de la Lithosphère: Orogénèse.** vol. III (fascicules 1 and 2) of *Traité de Géologie*. Henri Termier and Geneviève Termier. Masson, Paris, 1956; 1957. 498 pp.; 442 pp. Illus. + plates. F. 9800.

This imposing work, contained in two large and well-bound books, constitutes the third major subdivision of a broad geologic treatise undertaken by the authors. The first volume, *Historie Géologique de la Biosphère*, was published in 1952. A second volume, *Petrogénèse*, appeared in 1956 as the first division of a tripartite unit, *L'Évolution de la Lithosphère*, of which the volume reviewed here is the second division. A third part, *Glyptogénèse et Sedimentation*, volume IV of the general treatise, is in preparation. Other volumes, planned and in preparation, will treat the subject *les Temps Fossilifères*. Truly the authors have undertaken a monumental task.

Volume III has the following organization: Part 1, an introduction entitled "Generalities" (135 pages), gives definitions of important terms, outlines what is known about movements now occurring in the earth's crust, and describes the principal kinds of structural features found in deformed belts. Part 2 (23 pages) describes the several ocean basins and the chief topographic features of their floors, outlines the current knowledge on the associated rocks and bottom sediments, and gives some results of seismic explorations at sea. Part 3 (203 pages) discusses "The Laurasian Continents," with allocation of space as follows: North America (48 pages), Greenland (18 pages), Precambrian and Caledonian Europe (67 pages), Asia (70 pages). Part 4 (144 pages) considers "The Gondwanan Continents" in the following subdivisions: Africa (69 pages), The Indian Shield (15 pages), Australasia (36 pages), Antarctica (5 pages), South America (15 pages), conclusions on the Gondwana Lands (4 pages). Part 5, "The Tethyan Orogenes" (310 pages), is the largest major division. It considers the Paleozoic orogenic belts of Europe, the younger mountain zones that extend from lands bordering the Mediterranean across Asia into the Pacific, and units of the same general date in the Caribbean

region. The final division, part 6, is a brief "Essay on Megatectonics," which considers some general problems of global scale.

The volume has generally good mechanical organization. A list of source references follows the discussion of each important topic; there are 80 such lists, an average of one for every 12 pages of text. The final pages of the first fascicule give an indexed list of the preceding partial bibliographies and a complete subject-matter index for that fascicule. At the end of the volume is a 45-page alphabetical index, three columns per page, pertaining to subject matter in both fascicules, authors of reference works, and names of places. Following this are a complete table of figures and plates, a list of 49 tables contained in the text, a complete table of partial bibliographies, and a table of subject matter. By using these aids the reader can check, with minimum effort, almost any object of his search in the large volume. There are, however, exceptions; for example, the word *geosynclinal*, used frequently in the text, is not listed separately in the index.

The introductory chapters, written in lucid style and amply illustrated, make good reading. Little of the subject matter is controversial, though readers may take issue on some items, as on the inclusion (page 79) of Willis' classification of thrust faults; in my opinion the division into *stretch*-, *break*-, and *shear-thrusts* is based on no mechanical principles and is undesirable. The brief treatment of ocean basins, illustrated with helpful charts, is, on the whole, well done. The real meat of the volume is in the treatment of orogenic belts, and a reader's judgment of this treatment will depend in important degree on his location; generally he is best acquainted with his home continent. The first chapter of part 3, "Amérique du Nord," treats, in order, "The Drama of the Canadian Shield," "The Cordilleran Drama," and "The Appalachian Drama." For the Canadian part of the structural map (plate 9), one would suppose an important source must be the *Tectonic Map of Canada* (1950), but no reference is made to it. Representation of the several orogenic belts with dates based on radio-

active minerals is of interest, but the oldest date cited, 3500 million years, is now discredited—this figure has been pronounced about 25 percent too high.

Geologists in the United States will be primarily interested in sections that deal with the Appalachian and Cordilleran belts. Maps speak more eloquently than words, and readers who turn first to Fig. 41 (plate 13A), a structural outline of the Appalachian chain, may well react with astonishment. One of the few names on the map, Connecticut, is printed in prominent letters altogether west of the Hudson River, on an area ordinarily ascribed to New York, New Jersey, and Pennsylvania. A suggestion of tectonic transport is, of course, an unkind jest, but the authors should realize that a map of France involving a comparable error might show Paris and its environs directly south of Le Havre. And Fig. 41 is open to more serious criticism; it represents the Paleozoic rocks of New England as being *nonmetamorphic*, and a narrow belt extending far up the Hudson Valley as a northward extension of the Piedmont province, with metamorphic rocks. Figure 42 (plate 13B), directly following, shows the relationships exactly reversed insofar as the same areas are represented. Surely, two of the patterns in Fig. 42 are interchanged in the explanation, but correction of this error will not make Fig. 41 less defective, in the judgment of geologists familiar with the schistose Paleozoic section of New England and the nonmetamorphic formations in the upper Hudson-Champlain valley. Moreover, the figure has a heavy line, extending from New Jersey hundreds of miles southward, which unwary readers will assume is a great fault, but an identical line on Fig. 36 (plate 11) is labeled "fall line," a feature that has no place in a structural assemblage. Truly, Figs. 41 and 42 in their present form may convey much misinformation to anyone unfamiliar with Appalachian geology. Careful reading of the text makes amends, in part, but cannot undo the graphic misrepresentation.

Plate 12, which purports to present a structural outline of the Cordilleran region, also has serious defects. Geographic relationships are incorrectly shown: the north end of the Laramie Range is placed directly south of Yellowstone Park; an area that should hold the western edge of the Colorado Plateau is labeled "Rocky Mountains," and the only other appearance of this name is well east of the Lewis thrust trace, in a wide area shown with Precambrian bedrock; the Garlock fault and the southern part of the San Andreas fault are out of place and wrongly oriented. An area covering western Utah, much of Nevada, and parts of eastern California is labeled "zone poorly known"; yet some



of the most definite information on the Cordilleran geosyncline—a major feature of the map—has been found in that part of the Basin-Range country. On evidence much less secure, the authors have not hesitated to represent the “Beltian zone” as a continuous unit from northern Mexico to a high latitude in Canada. Even the Front and Laramie ranges are represented as “Beltian.” And the map gives no place to the zone of deformation commonly known as “Laramide,” though inclusion of Tertiary lava fields implies an aim to present a complete structural picture. The significance of the large areas indicated as being Precambrian is not clear. Figure 36 (plate 11), though drawn to smaller scale, presents the general tectonic features of the Cordilleran region more satisfactorily than does plate 12.

The brief list of source references cited for “The Cordilleran Drama” suggests that the authors may be unfamiliar with much of the published information. Another weakness of this section, and of the entire volume, is the lack of reference in the text to pertinent illustrations. Careful search through the pages dealing with North America has failed to locate one such reference, and in the entire volume the textual citation of figures is extremely rare, though some references are made to illustrations in the earlier volumes, on *Biosphère* and *Pétrogénèse*. Captions of plates 12 and 13 in the present volume are skeletal, and readers must look to the text for explanation of many details. Text and illustrations should be mutually complementary, and the reader would be helped, with respect both to economy of time and total return from his study, by a more systematic welding of the two forms of exposition than is evident in the Termier volume.

I do not feel competent to analyze critically much of the treatment related to other continents, but another unfavorable comment on the drawn illustrations seems in order. Most of the many maps have neither scale nor latitude-longitude coordinates. Lack of scale is unfortunate, especially for foreign readers, in such diagrams as plates 47 (Armorican massif), 50 (the Vosges), 51 (Black Forest), and many others. Anyone who is not familiar with these areas can comprehend the diagrams only by reference to an atlas, whereas a scale printed with each figure would give proper perspective at a glance. Plates 46 (Harz Mountains), 59 (part of Spain), and a few others have scales. Why are these so favored? Maps showing areas of continental dimensions should have both scale and latitude-longitude markers. Plate 28 (East Siberia) has these; why not plates 23 (Asia), 33 (Africa), 43 (South America), and others? The general viewpoint of geographers and geologists was once expressed

by Isaiah Bowman in the form of a riddle: “When is a map not a map? When it has neither scale nor coordinates.” It seems axiomatic that a structure-section too must have a scale, but this primal rule is not strictly observed by the Termiers, as witness their figures 116 (Fallot’s Beltic Cordillera) and 119 (Argand’s western Alps), both major cross sections reproduced without indication of their horizontal extent.

The numerous tables that summarize orogenic history are an admirable feature of the Termier volume. These tables are generally well executed and serve the reader not only as a useful guide in his reading but also as a ready source for reference in a search for specific information.

No doubt other readers of the volume will find weaknesses not listed here. It is a work that required stupendous labor—the digesting of geologic literature in several languages, involving countless man-hours spent in analysis and compilation. In the nature of human things, the result cannot be perfect. An over-all appraisal must recognize the high merit of this work as an attempt to integrate the results of geologic study into a global picture. Perhaps the result demonstrates that the task is too great for a small team in one country. Surely the most glaring weaknesses in the treatment of North American materials might have been eliminated through the aid of a well-informed structural geologist on this side of the Atlantic. In addition to the language difficulties, the size of the fast-growing mass of literature makes judicious summarizing and accurate graphic representation ever more difficult. The next major step may be a project similar to that represented by the volume *Orogénèse* but carried out by a competent international team. Meanwhile, the Termiers merit our gratitude for their devoted labors. Their volume is a highly useful reference work, and should be a stimulus to further cooperative studies in megatectonics.

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**Virus in the Cell.** J. Gordon Cook. Dial Press, New York, 1957. 208 pp. Illus. \$3.

This book is part of a *Science for Everyman* series and is written in very simple language. The first eight chapters deal with the principal virus diseases of man, and the emphasis is on epidemiology as well as on the history of the development of vaccines, from smallpox to poliomyelitis. The four chapters that follow deal with the viruses of animals, insects, bacteria, and plants. The title *Virus in the Cell* best fits the last six

chapters, which are devoted to basic research in virology. A fair number of illustrations, mainly from authoritative sources, is included.

It is a pleasant, exciting, and informative book to read. The degree of accuracy is adequate for a book of this type, though there are a few oversimplifications. For example, the typhus rickettsia is called a virus, and the distinction between virulent and temperate phages is not made. But, in general, the author does not shun complicated problems or recent advances.

This book is most appropriate for laymen and young readers. Perhaps some will be inspired to take up the study of virology.

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**The Quicksilver Doctor.** The Life and Times of Thomas Dover, Physician and Adventurer. Kenneth Dewhurst. Wright, Bristol, England, 1957. ix + 192 pp. Plates. 21s.

The advent of the antibiotics—biologic and chemotherapeutic agents—has reduced the compound powder of ipecacuanha and opium to a very lowly place in the physician’s therapeutic armamentarium. Yet for the past two hundred years, almost every physician has employed this useful diaphoretic and sedative, familiarly known as “Dover’s powder,” in the minor respiratory infections, and almost every teacher of pharmacology has passed on to his students the romantic, if not quite historically accurate, comment that its inventor was the pirate physician, Thomas Dover. But the fascinating story of this 18th-century physician needs no embroidering.

The younger son of a Royalist captain of horse, Thomas Dover became a pupil of the great Thomas Sydenham, from whom he acquired something of the true Hippocratic approach to clinical medicine and common-sense approach to therapy at a period when the practice of physic had been reduced, by theoretical systematists, to the imbecilities satirized by Molière. From successful medical practitioner at Bristol, he turned aside to become one of the leaders in the most successful privateering expedition of naval history, in which he rescued Alexander Selkirk, the prototype of Daniel Defoe’s Robinson Crusoe, from the island of Juan Fernandez, stormed the city of Guayaquil, and circumnavigated the globe. Thence, he continued his travels to Asia Minor, to return and lose all, a virtual bankrupt, in the South Sea “bubble.” Finally, as an epilogue to this romantic and chequered career, in his 70th year he engaged in one of the great



polemics of medicine with his advocacy of heroic doses of metallic mercury, from which he derived fame as the "Quicksilver Doctor," which episode gives title to this book.

This is a very enjoyable book, providing us not only with almost all that is known about Thomas Dover but placing him in his contemporary setting among his teachers, friends, acquaintances, and critics. Many a famous name—Radcliffe, Sloan, Mead, Dampier, Woodes Rogers, Lady Montagu—enters into the narrative. There are many details of Thomas Dover's life which are obscure or unknown, but the author, Kenneth Dewhurst, seems to have searched all possible sources and is thus able to expand the little that is known of his subject. However, the author gives 1662 as the date of Dover's birth, against 1660 in *The Dictionary of National Biography*, without apparently recognizing the inconsistency between his own sources—the admission register of Gonville and Caius and the baptismal register—and other entries. Likewise, Thomas is accepted as the editor of the 1770 edition of the *Annalia Dubrensia* memorializing his grandfather, whereas the internal evidence points to Thomas' older brother John. Supporters of the "light blue" will be a little disturbed to find (page 12) Cambridge's greatest ornament, William Harvey, "amongst the vanguard of Oxford pioneers." But these are trivia, in a tale exceptionally well told.

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**The Defect Solid State.** T. J. Gray, D. P. Detwiler, D. E. Rose, W. G. Lawrence, R. R. West, and T. J. Jennings. Interscience, New York, 1957. 511 pp. Illus. \$11.

This volume consists of a rather diffuse collection of essays, six of them by T. J. Gray and the other six by colleagues of his at the Alfred University College of Ceramics. Since little more than half of the material presented has anything to do with "the defect solid state," one might perhaps wonder why that title was chosen; perhaps the authors felt that it has a fashionable ring at the present time. At any rate, the book should prove interesting to some who work in other fields, notably ceramics and metallurgy.

Of the articles by Gray himself, it is difficult to write constructively. The author roams over the extensive field, or series of fields, to which he has contributed, touching in his path on the electrical properties of semiconductors and on dislocations, solid state diffusion, adsorption, oxide film growth, corrosion, magnetism, and catalysis. Unfortunately, the

result is highly disorganized; good critical comments lie next door to wild and inaccurate statements. It is staggering to find, for example, the sentence (page 34): "An accepted criterion for a semiconductor is that the material possesses a measurable Hall coefficient." More generally, a particular piece of mathematical work (or a particular argument) may crop up three or four times—often in a different notation each time—with no indication that the same territory has been covered in an earlier section. This trouble is worsened by what seems to have been remarkably sloppy proof-correcting of the equations. For example, in the five equations on pages 39 and 40 and the accompanying text, there are six typographical errors; of the equations, the fourth is irrelevant (quite apart from the fact that one of the symbols and one of the phrases associated with it are left unexplained and do not seem to occur again), while the fifth turns out, on close inspection, to be no more than an approximate form of the first, except that *every symbol is different!*

The most disappointing chapter is that on "Defect Structure and Catalysis." Precisely because this is such a woolly subject and because so much nonsense has been written on it, one looks for something better in the way of a critical survey than that offered here. One seeks in vain for some quantitative correlation, for example, between the activation energy of a catalyzed reaction and the position of the Fermi level (in the bulk or at the surface) in the catalyst. The chapter on "Magnetic Properties of Solids" is better, but it ignores almost everything that has been done in electronic paramagnetism in the last quarter century; electronic paramagnetic resonance (as distinguished from ferromagnetic resonance), for example, is not mentioned, and there is not even a reference to the modern work on crystal fields, which has led to an essentially complete solution of the problem of anomalous *g*-values.

The chapter by D. P. Detwiler on "Certain Theoretical Aspects of Semiconductivity" may be of use as an elementary introduction to the subject, and the chapter on "Dielectric Materials" by the same author is a competent, if not particularly novel, treatment of the static and dynamic electrical properties of insulators.

D. E. Rose's chapter on "Phase Equilibria" is a good piece of pedagogy and should be useful, both as an introduction and for reference purposes, to metallurgists. Detwiler's chapter on "Intermetallic Compounds" is too brief to be of much value. On the technological side, there are sections on "Experimental Techniques" by R. R. West (differential thermal analysis) and on "Microbalance Techniques" by T. J. Jennings. Possibly the best, and certainly the best written,

article in the book is W. G. Lawrence's chapter on "Ceramic Materials for High Temperatures." I am not competent to criticize the accuracy or comprehensiveness of the material in this chapter, but that material is well organized and attractively presented. It is a pity that the same cannot be said for all of the rest of the book.

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**Proceedings of the International Symposium on Algebraic Number Theory.** Tokyo and Nikko, Japan, September 1955. Science Council of Japan, Tokyo, 1956. 267 pp.

This volume records a successful symposium, organized by the Science Council of Japan under the joint sponsorship of the International Mathematical Union. The subject of algebraic number theory was well chosen, for the current developments of this subject are not only fruitful in their own right but reach effectively into other fields such as homological algebra and algebraic geometry. The location of the symposium in Japan was suitable, for the crown of algebraic number theory lies in the class field theory, which owes much to the pioneering papers published in 1920-22 by the Japanese mathematician T. Takagi (honorary president of this symposium). This interest has remained active, as witness the current contributions of Japanese mathematicians such as Iwasawa, Nakayama, and Tannaka to the beautiful recent developments of class field theory.

The symposium assembled some ten mathematicians from abroad, as well as 55 from Japan. This volume, after presentation of introductory material, presents the mathematical addresses which they delivered at the symposium. Noteworthy is the rapid development of the study of the "complex multiplication" which arises in the description of class fields over certain special algebraic number fields (imaginary quadratic fields). Recent work here was stimulated by papers of A. Weil, of about 1950, and was carried further by M. Deuring, who reports here on his results. Further essential progress has been achieved by the young Japanese mathematicians G. Shimura and Y. Taniyama, whose results overlap current ones of Weil (all reported here), and the discussions at the symposium between these men and others manifestly contributed more ideas for the future (see, for example, pages 9, 32).

Many other developments are represented: modern methods in class field theory involving the study of *idèle* class group (E. Artin, A. Weil) and of cohomology groups; the use of such geo-

metric methods as fiber spaces in number theory (K. Yamazaki, following ideas of A. Weil); and number theory in algebraic varieties (A. Neron). Algebraic geometry is well represented: M. Nagata gives a systematic exposition of his general treatment of intersection multiplicities, following notions of C. Chevalley; J. P. Serre shows how the new methods of homological algebra yield improved proofs of the Cohen-Macaulay theorems, and so on. Other articles follow, and the volume ends with 17 short notes by younger Japanese mathematicians. As a statement by the visitors (page xxxi) points out, the material conditions of young Japanese scientists are not favorable, but their devotion and talent are amply displayed here.

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## New Books

*The Origin of Life on the Earth.* A. I. Oparin. Translated from the Russian by Ann Synge. Academic Press, New York, rev. ed. 3, 1957. 513 pp. \$6.80.

*Edward Williams Morley.* His influence on science in America. Howard R. Williams. Chemical Education, Easton, Pa., 1957. 293 pp.

*An Introduction to Genetic Statistics.* Oscar Kempthorne. Wiley, New York; Chapman & Hall, London, 1957. 572 pp. \$12.75.

*Better Biology for High School.* D. K. Gillespie. Vantage Press, New York, 1957. 249 pp. \$3.50.

*Check-List of North American Birds.* Prepared by a committee of the American Ornithologists' Union. American Ornithologists' Union, 1957. 704 pp.

*Hepatitis Frontiers.* Frank W. Hartman, Gerald A. LoGrippe, John G. Mateer, James Barron. Little, Brown, Boston, 1957. 605 pp. \$12.50.

*Radiation Effects in Solids.* G. J. Dienes and G. H. Vineyard. Interscience, New York, 1957. 234 pp. \$6.50.

*Cosmic View.* The universe in 40 jumps. Kees Boeke. Day, New York, 1957. 48 pp. \$3.25.

*Social and Cultural Dynamics.* A study of change in major systems of art, truth, ethics, law and social relationships. Pitirim Sorokin. Sargent, Boston, revised and abridged in one volume, 1957. 718 pp. \$7.50.

*Treatise on Marine Ecology and Paleocology.* vol. 2, *Paleocology.* Memoir 67. Harry S. Ladd, Ed. Geological Society of America, New York, 1957. 1087 pp. \$10.

*New Frontiers of Knowledge.* A symposium by distinguished writers, notable scholars and public figures. Public Affairs Press, Washington, 1957. 135 pp. \$2.75.

*El Archipiélago de Los Roques y La Orchila.* Sociedad de Ciencias Naturales la Salle, Caracas, Venezuela, 1956. 257 pp.

*The Elements of Physics.* Alpheus W. Smith and John N. Cooper. McGraw-Hill, New York, ed. 6, 1957. 683 pp. \$7.50.

*Guide to the Microscope.* Arthur Beiser. Dutton, New York, 1957. 127 pp. \$3.25.

*Education for Planning: City, State and Regional.* Harvey S. Perloff. Johns Hopkins Press (for Resources for the Future), Baltimore, 1957. 199 pp. \$3.50.

*Chronic Illness in a Large City. The Baltimore Study.* vol. IV of *Chronic Illness in the United States.* Commission on Chronic Illness. Harvard University Press (for the Commonwealth Fund), Cambridge, Mass., 1957. 639 pp. \$8.

*Community Involvement.* The webs of formal and informal ties that make for action. Christopher Sower, John Holland, Kenneth Tiedke, Walter Freeman. Free Press, Glencoe, Ill., 1957. 323 pp. \$5.

*College Men at War.* Memoirs, vol. 24. John P. Monks. American Academy of Arts and Sciences, Boston, 1957. 334 pp. \$10.00.

*The Origins of Modern Science 1300-1800.* H. Butterfield. Macmillan, New York, ed. 2, 1957. 252 pp. \$3.

*West Africa.* A study of the environment and of man's use of it. R. J. Harrison Church. Longmans, Green, London, 1957 (order from Longmans, Green, New York). 574 pp. \$8.75.

*Biochemie der Ernährung.* K. Lang. Steinkopff, Darmstadt, Germany, 1957. 426 pp. DM. 54.

*The American Idea of Mission.* Concepts of national purpose and destiny. Edward McNall Burns. Rutgers University Press, New Brunswick, N.J., 1957. 397 pp. \$9.

*Automation: What It Is, How It Works, Who Can Use It.* Carl Dreher. Norton, New York, 1957. 128 pp. \$2.95.

*Neutron Cross Sections.* Donald J. Hughes. Pergamon Press, New York, 1957. 192 pp. \$5.

*Fear: Contagion and Conquest.* James Clark Moloney. Philosophical Library, New York, 1957. 153 pp. \$3.75.

*The Numbers of Man and Animals.* J. B. Cragg and N. W. Pirie, Ed. Oliver and Boyd (for the Institute of Biology), Edinburgh, 1957 (order from Macmillan, New York). 160 pp. \$2.75.

*Installing Electronic Data Processing Systems.* Richard G. Canning. Wiley, New York; Chapman & Hall, London, 1957. 203 pp. \$6.

*The Economics of Under-Developed Countries.* Peter T. Bauer and Basil S. Yamey. University of Chicago Press, Chicago, 1957. 284 pp. \$2.25.

*Biological Effects of Whole-Body Gamma Radiation on Human Beings (U).* Harold O. Davidson. Johns Hopkins Press (for Operations Research Office, Johns Hopkins University), Baltimore, 1957. 101 pp. \$3.

*Catalysis.* vol. 5, *Hydrogenation, Oxosynthesis, Hydrocracking, Hydrodesulfurization, Hydrogen Isotope Exchange and Related Catalytic Reactions.* Paul H. Emmett, Ed. Reinhold, New York; Chapman & Hall, London, 1957. 548 pp. \$15.

*Trends in Gerontology.* Nathan W. Shock. Stanford University Press, Stanford, Calif., ed. 2, 1957. 223 pp. \$4.50.

*The Inner Metagalaxy.* Harlow Shapley. Oxford University Press, London; Yale University Press, New Haven, Conn., 1957. 217 pp. \$6.75.

## Miscellaneous Publications

(Inquiries concerning these publications should be addressed, not to Science, but to the publisher or agency sponsoring the publication.)

*Paralepididae II (Macroparalepis).* Taxonomy, ontogeny, phylogeny and distribution. Carlsberg Foundation's oceanographical expedition round the world 1928-30 and previous "Dana"-expeditions. Vilh. Ege. Carlsberg Foundation, Copenhagen, Denmark, 1957. Kr. 28.

*Botany.* Laboratory manual. Erich Steiner, Alfred S. Sussman, Warren H. Wagner, Jr. Dryden Press, New York, 1957. 260 pp. \$3.40.

*Digital Differential Analyzers.* George F. Forbes. The author, 10117 Barteet Ave., Pacoima, Calif., ed. 4, 1957. 175 pp. \$5.

*The Electrophysiology of the Heart.* Annals, vol. 65, art. 6. Hans H. Hecht, conference chairman and consulting editor. 494 pp. \$4.50. *Proteolytic Enzymes and Their Clinical Application.* vol. 68, art. 1. Gustav J. Martin, consulting editor and conference chairman. 224 pp. \$3.50. *Biological Applications of Infrared Spectroscopy.* vol. 69, art. 1. Robert P. Bauman, consulting editor. 254 pp. \$3.50. *Modern Ideas on Spontaneous Generation.* vol. 69, art. 2. Ross F. Nigrelli, conference chairman and consulting editor. 122 pp. \$2.50. *Second Conference on Sulfonamides.* vol. 69, art. 3. Perrin H. Long, consulting editor. 148 pp. \$3. *The Role of I<sup>131</sup>-Labeled Proteins in Biology and Medicine.* vol. 70, art. 1. S. P. Masouredis, conference chairman and consulting editor. 152 pp. \$3. *Determination of SR<sup>19</sup> and BA<sup>19</sup> in Bone, Dairy Products, Vegetation, and Soil.* vol. 71, art. 2. H. L. Volchok, J. L. Kulp, W. R. Eckelmann, J. E. Gaetjen. 12 pp. \$0.75. *Transplantation of Fins in Xiphophorus Fishes.* vol. 71, art. 3. Klaus D. Kallman and Myron Gordon. 16 pp. \$0.75. New York Academy of Sciences, New York, 1957.

*A Restudy of the 1917 Eruption of Volcán Bôqueron, El Salvador, Central America.* Fieldiana: Geology, vol. 10. No. 30. Sharat Kumar Roy. 20 pp. \$0.75. *The Problems of the Origin and Structure of Chondrules in Stony Meteorites.* vol. 10, No. 31. Sharat Kumar Roy. 14 pp. \$0.50. Chicago Natural History Museum, Chicago, 1957.

*Eocene Mollusca from Nigeria: a Revision.* Bulletin, Geology, vol. 3, No. 2. Frank E. Eames. 48 pp. 25s. *A Revision of the Lake Victoria Haplochromis Species (Pisces, Cichlidae).* pt. II, H. Sawagui (Pfeffer), H. Prodromus Trewavas, H. Granti Blgr., and H. Xenognatus, Sp. N. Bulletin, Zoology, vol. 5, No. 4. P. H. Greenwood. 22 pp. 8s. *Neuroptera and Trichoptera Collected by Mr. J. D. Bradley on Guadalcanal Island, 1953-54.* Bulletin, Entomology, vol. 5, No. 7. D. E. Kimmins. 22 pp. 7s. *Odonata Collected by Mr. J. D. Bradley on Guadalcanal Island, 1953-54.* Bulletin, Entomology, vol. 5, No. 8. D. E. Kimmins. 12 pp. 4s. The British Museum (Natural History), London, 1957.

*The Public Health Laboratory Service.* First report of the Expert Committee on Health Laboratory Methods. WHO Tech. Rept. Ser., No. 128. World Health Organization, Geneva, 1957. 49 pp. \$0.60.

## Meetings and Societies

### Nuclear Sex

The introduction of a relatively simple method of chromosomal sex detection by Moore, Graham, and Barr in 1953 focused attention on the sex chromosomes of somatic cells and served as a starting point for much new work on human sex anomalies. In view of the rapid and unexpected developments and the diversity of disciplines involved, an exchange of information within a small but representative group of workers in this field seemed advisable. Accordingly, a group of scientists in Great Britain arranged a Symposium on Nuclear Sex, which took place in King's College Hospital Medical School on 6-7 September. In addition to aid from that medical school, aid to help defray the costs of the symposium was provided by the Wellcome Foundation and the Ciba Foundation. About 70 persons participated by invitation, coming from Austria, Canada, Denmark, France, Germany, Great Britain, Israel, Italy, Portugal, Switzerland, and the United States. Emphasis was on informal discussion, which cannot be accurately reported here, but the following notations concerning individual papers will give some idea of current trends in this field.

The first session, under the chairmanship of L. S. Penrose, was devoted to cytologic and genetic aspects of nuclear sex. B. Slizynski sought to explain the recorded incidence of 60 to 80 percent for sex chromatin in the nuclei of sections of various tissues from females on the basis of somatic inconstancy of chromosome number. It was pointed out by other participants that published figures for the incidence of sex chromatin are too low, since corrections have seldom been made for the mean diameter of nuclei being greater than the thickness of the section. C. E. Ford presented evidence in favor of a chromosome number of 46 rather than 48 in man and discussed the nature of the pairing between X and Y chromosomes (end to end and inconstant). He stressed the need for more detailed information on the morphology of individual chromosomes in man and struck an optimistic note with respect to techniques now being developed.

J. L. Hamerton described the struc-

ture and behavior of the sex chromosomes in *Rattus natalensis* and showed that normal pairing and chiasma formation between the homologous segments of the X and Y chromosomes occur regularly in this species. C. Leuchtenberger drew attention to refined techniques that may be brought to bear on the problem of nuclear composition. As examples, she presented microspectrophotometric and interferometric determinations of desoxyribonucleic acid, arginine, and dry mass in sperm nuclei of fertile men and fertile bulls. The amount of arginine was about 80 percent less in human than in bull sperm, but the desoxyribonucleic acid content and dry mass were similar in the two species.

H. P. Klinger described the detailed morphology of the sex chromatin of female cells, stressing its bipartite structure, which supports the contention that the sex chromatin represents heterochromatic regions of the two X chromosomes. Division of the sex chromatin prior to amitotic division in fetal membranes was also described. Klinger's introduction of mild acid hydrolysis followed by staining with thionin has brought a valuable improvement to the staining of sections and smears. P. Riis showed that the sex chromatin of lymphocytes from females becomes unmasked as pyknotic nuclei change to vesicular nuclei *in vitro*.

L. Sachs and M. Danon favored the genetic origin of human sex anomalies in general. They pointed out that genetic factors operate at the following levels: (i) on the development of the gonads (agenesis in Turner's syndrome and extreme dysgenesis in Klinefelter's syndrome); (ii) on the synthesis of steroid hormones (adrenogenital syndrome); or (iii) on tissue response to hormones (syndrome of testicular feminization). They also presented preliminary evidence for a nuclear mosaicism (XX and XO) in some cases of gonadal agenesis and for an unusual sex chromosome complex (XXY) in the syndrome of testicular feminization. The meticulous study of chromocenters (of which the sex chromatin is one) in resting nuclei, by Sachs and Danon, opens the way to refinements in the tests of chromosomal sex.

The second session, for which P. M. F.

Bishop was chairman, dealt with the application of the sex chromatin principle to anomalies of sex development in man. Danon and Sachs indicated that the primary role of the sex chromosomes is to direct normal gonadal differentiation. When they fail in this, there is a sequence of events that may lead to the phenotypical sex being contrary to the chromosomal sex, as occurs in the syndromes of Turner and Klinefelter. C. Overzier suggested a classification of sex anomalies and developed the hypothesis that Wolffian and Mullerian ducts are exposed to an "initial induction" by the anlage of the gonads and to a "permanent induction" by gonads in a later stage of maturation. Interference with initial or permanent induction could explain some variants of Turner's syndrome.

A. Prader described a new congenital syndrome, with lipoid adrenal hyperplasia and adrenal insufficiency, which causes feminization in boys. He suggested that the syndrome stems from a hereditary enzymatic failure of steroid synthesis in the fetal adrenal cortex and in the Leydig cells of the fetal testis. D. J. B. Ashley presented the first reported instance of a patient with ovarian tissue only (insofar as this could be established by laparotomy and gonadal biopsy), with male nuclei in oral smear and skin biopsy. However, the issue was confused by the finding of female-type neutrophils in the blood film.

E. Slater reported uniform agreement between chromosomal and somatic sex in homosexuality and transvestitism. Family studies of sex deviates showed that they were likely to occupy a late position in the sibship. C. N. Armstrong described a male transvestite in detail and suggested that there may be a specific constitutional factor on a genetic basis, even though psychological factors contribute to causation. H.-R. Wiedemann submitted data derived from use of the neutrophil test of sex in a large series of sex anomalies. The test proved reliable except in some instances of Klinefelter's syndrome.

The remainder of this session was given over to a discussion of Klinefelter's syndrome, which has recently (and quite unexpectedly) been shown to include patients with an apparent female-to-male sex reversal. B. Lennox, M. A. Ferguson Smith, W. S. Mack, and J. S. S. Stewart found that, of all men with any degree of oligospermia who attended an infertility clinic, about 3 percent were chromosomal females. Patients classified as Klinefelter's syndrome could be identified as chromosomal females or chromosomal males on the basis of qualitative and quantitative differences in testicular histopathology. R. E. Siebenmann also stressed the constancy of severe testicular abnormality in Klinefelter's syndrome



with female nuclei, in contrast to the variable and less severe testicular pathology in Klinefelter's syndrome with male nuclei. W. M. Davidson and D. Robertson Smith confirmed sporadic reports that the incidence of female-type neutrophils may be unexpectedly low in patients with Klinefelter's syndrome and female nuclei elsewhere. The cause of this discrepancy is obscure, but it cannot be attributed to a leftward shift in the Arneith index of nuclear lobulation.

P. M. F. Bishop, M. A. Ferguson Smith, B. Lennox, P. Polani, and J. S. S. Stewart found that the incidence of defective color vision in Klinefelter's syndrome was consistent with the sex chromosome constitution (XX in one group, XY in the other) as inferred from cytological tests of chromosomal sex. J. S. S. Stewart, M. Izatt, M. A. Ferguson Smith, B. Lennox, and W. S. Mack found a high incidence of sterility among the

uncles of patients with Klinefelter's syndrome. Paternal uncles were affected in cases where the patients had female nuclei, and maternal uncles were affected in cases where the patients had male nuclei. A hereditary mechanism was postulated, based on an autosomal translocation involving the masculinizing (M) genes (female nuclei = MMMXX, male nuclei = MXY).

The application of the sex chromatin principle to the study of tumors was the subject for the third and final session of the symposium, with M. L. Barr acting as chairman. L. Myers presented data on the nuclei of teratomas. The nuclei were female in tumors from female hosts, except that the sex chromatin could not be identified accurately in a few tissues of malignant teratomas. Tumors from male hosts had, for the most part, typical male or female nuclei, as has previously been reported. However, some

testicular tumors were encountered with a mosaicism of the nuclei, since they were female in some tissues and male in others. Discussants of the paper felt that the latter observation did not necessarily invalidate the etiological hypotheses of Hunter and Lennox and of Tavares (both hypotheses having haploid cells as their starting point), when chromosomal anomalies in malignant cells and technical difficulties are taken into consideration.

A. S. Tavares reported on the sex characteristics of differentiated-cell carcinomas compared with undifferentiated-cell carcinomas, using malignant tissues from female hosts. The sex chromatin of differentiated-cell carcinomas was similar to that of nonmalignant tissues. In undifferentiated-cell carcinomas, on the other hand, the incidence of sex chromatin in a population of nuclei was exceedingly variable, the figures for some tumors falling within the male, or an intermediate, range. N. B. Atkin described the chromosomes and sex chromatin of human cancer cells from female hosts, as seen in squash preparations. One mass of sex chromatin per nucleus was the rule for most of the tumors. However, there was no typical sex chromatin in the nuclei of a few tumors (they may have lost the XX complex), and two masses of sex chromatin were present in most nuclei of other tumors (they were probably tetraploid, as indicated by nuclear size, chromosome counts, and desoxyribonucleic acid content).

The symposium concluded with a summary by Barr. A committee was appointed to consider a revision of the classification of sex anomalies and their terminology in the light of current developments. Robert Platt, president of the Royal College of Physicians, was the principal speaker at a dinner given by the dean and council of King's College Hospital Medical School.

MURRAY L. BARR

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## Ethology and Comparative Psychology

Between 9 July and 3 August a conference on ethology and comparative psychology was held at the Center for Advanced Study in the Behavioral Sciences, Stanford, Calif. The purpose of the conference was to facilitate the exchange of ideas between representatives of ethology and comparative psychology. No formal program or agenda was drawn up in advance of the meeting, and no "papers" in the usual sense were presented. Each participant reported results of his more recent investigations. This took approxi-

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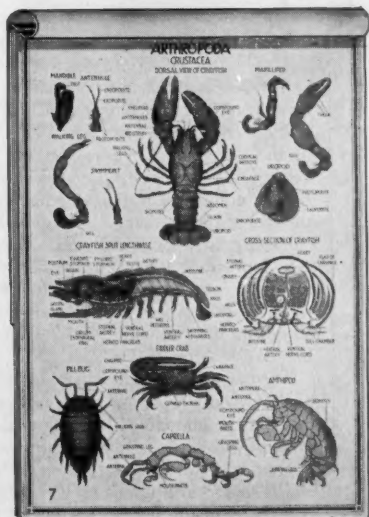
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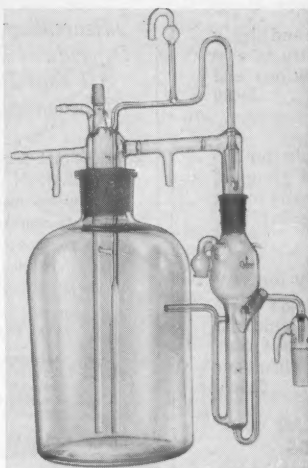
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mately 2 weeks in all. The second half of the conference was given over to the discussion of general theoretical issues, such as the use of formal and physiological genetics in the interpretation of behavior, the ontogeny of behavior, the role of physiology in behavioral theory, phylogenetic differences in motivational systems, and "drive" as a hypothetical concept and as an intervening variable, and of a number of specialized ethological concepts, including those of displacement activities, innate releasing mechanisms, and imprinting.

Because the conference was planned as an informal, relatively unstructured series of meetings, and because each participant was promised that he would not be required to produce any publishable paper, the results of the conference will not appear in any journal or book. However, intangible results were numerous and important, and each contributor felt that his own thinking and research would benefit greatly as a consequence of the discussions.

The expenses of the conference were defrayed by the Center. The participants were Gerard Baerends (University of Groningen), Frank Beach (Yale University), Harry Harlow (University of Wisconsin), Donald Hebb (McGill University), Eckard Hess (University of Chicago), Robert Hinde (Cambridge University), Jan van Iersel (Leiden University), Daniel Lehrman (Rutgers University), Jay Rosenblatt (American Museum of Natural History), Niko Tinbergen (Oxford University), and David Vowles (University of Reading).

FRANK A. BEACH

*Center for Advanced Study  
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Stanford, California*

### International Biochemistry Congress

The National Science Foundation, the American Society of Biological Chemists, and the Division of Biological Chemistry of the American Chemical Society are cooperating to support the travel of a limited number of American scientists to the fourth International Congress of Biochemistry, to be held in Vienna, Austria, 1-7 September 1958. The closing date for the receipt of applications is 1 February 1958. Application blanks are available from the National Science Foundation, Washington 25, D.C.

The size of each grant will be sufficient to defray only a part of the travel costs incurred in attending the congress. An attempt will be made to have the awards approximate air-coach fare from the scientists' home institutions to Vienna and return. As in the past, a portion of the funds will be used to support the travel of qualified younger investigators who have not had the opportunity to attend an international congress.

## Conference on Salt Marshes

The Marine Institute of the University of Georgia has announced that a Conference on Salt Marshes is to be held at Sapelo Island 25-28 March 1958. The conference, which is being sponsored jointly by the institute and the National Science Foundation, will be international in character. A group of about 25 people has participated in the conference; however, invitations will be extended on request to a limited number of additional persons who wish to attend at their own expense. The conference is under the direction of Alfred C. Redfield of Woods Hole, Mass. Inquiries should be directed to Dr. Robert A. Ragotzke, University of Georgia Marine Institute, Sapelo Island, Ga.

## Forthcoming Events

### December

26-30. American Assoc. for the Advancement of Science, annual, Indianapolis, Ind. (R. L. Taylor, AAAS, 1515 Massachusetts Ave., NW, Washington 5.)

The following 44 meetings are being held in conjunction with the AAAS annual meeting.

AAAS Acad. Conference, annual (Father P. H. Yancey, Spring Hill College, Mobile, Ala.). 28 Dec.

AAAS Cooperative Committee on the Teaching of Science and Mathematics (F. B. Dutton, Dept. of Chemistry, Michigan State Univ., East Lansing). 27 Dec.

Alpha Epsilon Delta (M. L. Moore, 7 Brookside Circle, Bronxville, N.Y.). 28 Dec.

American Astronomical Soc. (J. A. Hynek, Smithsonian Astrophysical Observatory, 60 Garden St., Cambridge 38, Mass.). 27-30 Dec.

American Geophysical Union (E. M. Brooks, Dept. of Geophysics, St. Louis Univ., St. Louis 8, Mo.).

American Medical Assoc. Committee on Cosmetics (Mrs. V. L. Conley, AMA, 535 N. Dearborn St., Chicago, Ill.). 28-29 Dec.

American Meteorological Soc. (K. C. Spengler, AMS, 3 Joy St., Boston, Mass.).

American Nature Study Soc., annual (R. L. Weaver, School of Natural Resources, Univ. of Michigan, Ann Arbor). 26-30 Dec.

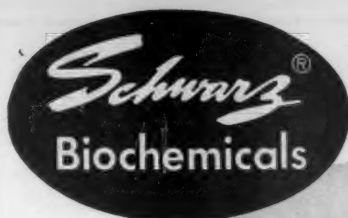
American Physiological Soc. (F. A. Hitchcock, Dept. of Physiology, Ohio State Univ., Columbus 10.)

American Political Science Assoc. (C. S. Hyneman, Dept. of Government, Indiana Univ., Bloomington). 29 Dec.

American Psychiatric Assoc. (M. Greenblatt, Massachusetts Mental Health Center, 74 Fenwood Rd., Boston 15). 29-30 Dec.

American Soc. of Hospital Pharmacists (G. E. Archambault, Pharmacy Branch, U.S. Public Health Service, Washington 25).

American Soc. of Naturalists (B. Wallace, Biological Lab., Cold Spring Harbor, Long Island, N.Y.).



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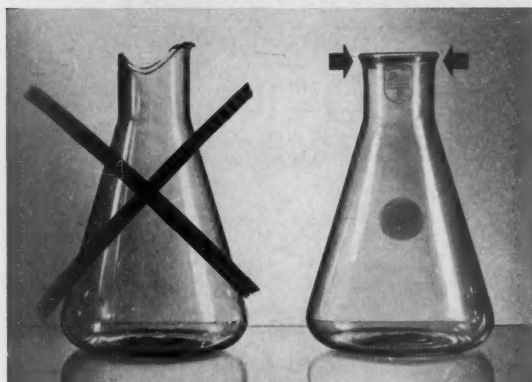
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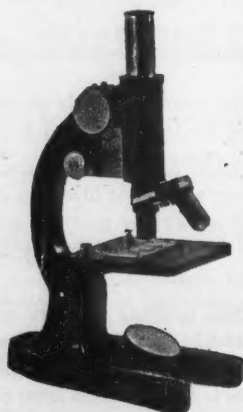
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American Sociological Soc. (V. H. Whitney, Brown Univ., Providence, R.I.). 28 Dec.

American Statistical Assoc. (V. L. Anderson, Statistical Lab., Purdue Univ., Lafayette, Ind.).

Association of American Geographers (L. L. Ray, U.S. Geological Survey, Washington 25).

Association for Computing Machinery (J. E. Robertson, Digital Computer Lab., Univ. of Illinois, Urbana).

Astronomical League (W. Garnatz 2506 South East St., Indianapolis).

Beta Beta Beta (Mrs. F. G. Brooks, P.O. Box 336, Madison Sq. Station, New York 10). 27 Dec.

Biometric Soc., ENAR (T. A. Bancroft, Dept. of Statistics, Iowa State College, Ames).

Conference on Scientific Editorial Problems, annual (G. L. Seielstad, Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.). 26-30 Dec.

Conference on Scientific Manpower, annual (T. J. Mills, National Science Foundation, Washington 25). 30 Dec.

Ecological Soc. of America (A. A. Lindsey, Dept. of Biological Sciences, Purdue Univ., Lafayette, Ind.). 27-29 Dec.

Metric Assoc. (J. T. Johnson, 694 West 11 St., Claremont, Calif.).

National Acad. of Economics and Political Science (D. P. Ray, Hall of Government, George Washington Univ., Washington, D.C.).

National Assoc. of Biology Teachers, annual (Miss I. Hollenbeck, Southern Oregon College of Education, Ashland). 26-31 Dec.

National Assoc. for Research in Science Teaching (G. G. Mallinson, Western Michigan College, Kalamazoo). 26-30 Dec.

National Assoc. of Science Writers (J. Troan, Pittsburgh Press, Pittsburgh, Pa.).

National Council of Teachers of Mathematics (P. Peak, College of Education, Indiana Univ., Bloomington). 27 Dec.

National Foundation for Junior Museums (J. R. Forbes, NFJM, 114 E. 30 St., New York 16). 26, 28 Dec.

National Geographic Soc. (W. R. Gray, NCS, 16th and M Sts., NW, Washington 6). 29 Dec.

National Science Teachers Assoc. (R. W. Schulz, Emmerich Manual Training High School, 2405 Madison Ave., Indianapolis 25). 26-30 Dec.

National Speleological Soc. (Brother G. Nicholas, LaSalle College, 20th and Olney Aves., Philadelphia 41, Pa.) 28 Dec.

Philosophy of Science Assoc. (C. W. Churchman, Case Inst. of Technology, Cleveland, Ohio).

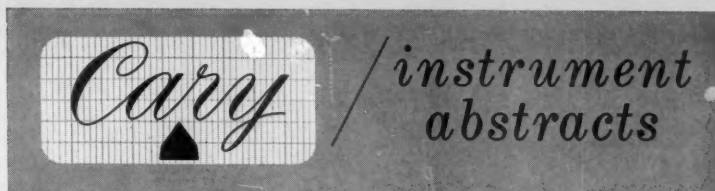
Scientific Research Soc. of America, annual (D. B. Prentice, 56 Hillhouse Ave., New Haven 11, Conn.). 27 Dec.

Sigma Delta Epsilon, annual (Miss M. Chalmers, Dept. of Chemistry, Purdue Univ., Lafayette, Ind.). 26-30 Dec.

Sigma Pi Sigma (M. W. White, Pennsylvania State Univ., University Park). 27 Dec.

Society for the Advancement of Criminology (D. E. J. MacNamara, New York Inst. of Criminology, 40 E. 40 St., New York 16). 27-28 Dec.

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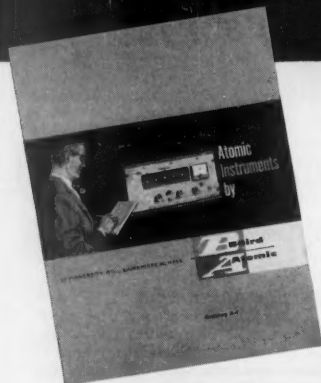
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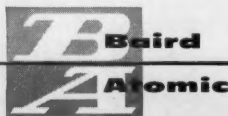


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annual (R. L. Meier, Mental Health Research Inst., Ann Arbor, Mich.).

Society for Industrial Microbiology, Washington Section (W. N. Ezekiel, Bureau of Mines, Washington 25).

Society for Investigative Dermatology (H. Beerman, Univ. of Pennsylvania School of Medicine, Philadelphia 3), 28-29 Dec.

Society of the Sigma Xi, annual (T. T. Holme, 56 Hillhouse Ave., New Haven 11, Conn.). 27 Dec.

Society of Systematic Zoology, annual (R. E. Blackwelder, Box 500, Victor, N.Y.). 26-31 Dec.

United Chapters of Phi Beta Kappa, annual address (C. Billman, 1811 Q St., NW, Washington, D.C.). 27 Dec.

27. Association for Symbolic Logic, Cambridge, Mass. (J. Barlaz, Rutgers Univ., New Brunswick, N.J.)

27-28. Linguistic Soc. of America, Chicago, Ill. (A. A. Hill, Box 7790, University Station, Austin 12, Tex.)

27-30. American Finance Assoc., annual, Philadelphia, Pa. (G. E. Hassett, Jr., New York Univ., 90 Trinity Pl., New York 6.)

28-29. American Folklore Soc., annual, Chicago, Ill. (M. Leach, Box 5, Bennett Hall, Univ. of Pennsylvania, Philadelphia 4, Pa.)

28-30. American Anthropological Assoc., annual, Chicago, Ill. (W. S. Godfrey, Jr., Logan Museum, Beloit College, Beloit, Wis.)

28-30. American Economic Assoc., annual, Philadelphia, Pa. (J. W. Bell, Northwestern Univ., Evanston, Ill.)

28-30. Archaeological Inst. of America, annual, Washington, D.C. (C. Boulter, 608, Univ. of Cincinnati Library, Cincinnati 21, Ohio.)

28-30. Econometric Soc., Philadelphia, Pa. (R. Ruggles, Dept. of Economics, Yale Univ., New Haven, Conn.)

28-30. History of Science Soc., annual, New York, N.Y. (Miss M. Boas, Brandeis Univ., Waltham 54, Mass.)

### January

6-8. Reliability and Quality Control, 4th natl. symp., Washington, D.C. (C. M. Ryerson, RCA Bldg. 10-6, Camden 2, N.J.)

7-10. Radioactive Isotopes in Clinical Application and Research) 3rd internat. symp., Bad Gastein, Austria. (Second Medical Clinic, Vienna Univ., Vienna Austria.)

8-10. Northeastern Weed Control Conf., 12th annual, New York. (R. J. Aldrich, Farm Crops Dept., Rutgers Univ., New Brunswick, N.J.)

13-17. Society of Automotive Engineers, annual, Detroit, Mich. (Meetings Div., SAE, 29 W. 39 St., New York 18.)

17-18. Blood Symposium, 7th annual, Detroit, Mich. (W. H. Seegers, Dept. of Physiology and Pharmacology, Wayne State Univ. College of Medicine, 1401 Rivard, Detroit 7.)

22-24. American Council of Learned Societies, 39th annual, Bloomington, Ind. (ACLS, 2101 R St., NW, Washington 8.)

22-25. American Group Psychotherapy Assoc., 15th annual, New York. (M. Berger, 50 E. 72 St., New York 21.)

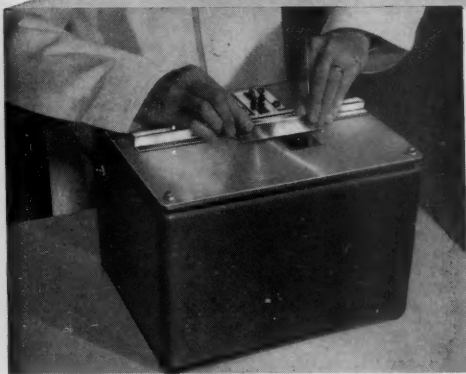


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27-28. Scintillation Counter Symp., Washington, D.C. (G. A. Morton, Radio Corporation of America, Princeton, N.J.)

27-29. American Soc. of Heating and Air-Conditioning Engineers, Pittsburgh, Pa. (A. V. Hutchinson, ASHAE, 62 Worth St., New York 13.)

27-30. American Meteorological Soc., 163rd natl., New York. (K. C. Spengler, AMS, 3 Joy St., Boston 8, Mass.)

27-31. Institute of Aeronautical Sciences, 26th annual, New York, N.Y. (S. P. Johnston, IAS, 2 E. 64 St., New York 24.)

28-30. Aging, 4th Ciba Foundation Colloquium (by invitation), London, England. (G. E. W. Wolstenholme, 41 Portland Pl., London, W.1.)

28-30. American Mathematical Soc., 64th annual, Cincinnati, Ohio. (J. H. Curtiss, AMS, 190 Hope St., Providence 6, R.I.)

29-1. American Physical Soc., annual, New York, N.Y. (K. K. Darrow, Columbia Univ., New York 27.)

30-31. College-Industry Conf., American Soc. for Engineering Education, 10th annual, Ann Arbor, Mich. (W. D. McIlvaine, College of Engineering, Ann Arbor.)

30-31. Mathematical Assoc. of America, annual, Cincinnati, Ohio. (H. M. Gehman, Univ. of Buffalo, Buffalo 14, N.Y.)

30-1. American Assoc. of Physics Teachers, New York. (F. Verbrugge, Univ. of Minnesota, Minneapolis.)

30-1. Western Soc. for Clinical Research, 11th annual, Carmel-by-the-Sea, Calif. (A. J. Seaman, Univ. of Oregon Medical School, Portland 1.)

31-1. Problems of Geriatrics, symp. (by invitation only), New York. (B. F. Chow, Johns Hopkins Univ., School of Hygiene and Public Health, 615 N. Wolfe St., Baltimore 5, Md.)

## February

1-14. Pan American Assoc. of Ophthalmology, Caribbean cruise cong., sailing from New York, N.Y. (L. V. Arnold, 33 Washington Sq. W., New York 11.)

3-4. Progress and Trends in Chemical and Petroleum Instrumentation, Wilmington, Del. (H. S. Kindler, Instrument Soc. of America, 313 Sixth Ave., Pittsburgh 22, Pa.)

3-7. American Inst. of Electrical Engineers, winter genl., New York, N.Y. (N. S. Hibshman, AIEE, 33 W. 39 St., New York 18.)

10-14. American Soc. for Testing Materials, St. Louis, Mo. (F. F. Van Atta, ASTM, 1916 Race St., Philadelphia 3, Pa.)

13-15. National Soc. of Professional Engineers, spring, East Lansing, Mich. (NSPE, 2029 K St., NW, Washington 6.)

16-20. American Inst. of Mining, Metallurgical and Petroleum Engineers, annual, New York. (E. O. Kirkendall, AIME, 29 W. 39 St., New York 18.)

20-21. Transistor and Solid State Cir-

cuits Conf., Philadelphia, Pa. (J. H. Milligan, Jr., Dept. of Electrical Engr., New York Univ., New York 53.)

24-28. American Soc. of Civil Engineers, Chicago, Ill. (W. W. Wisely, ASCE, 33 W. 39 St., New York 18.)

## March

1. Junior Solar Symposium, Tempe, Ariz. (Association for Applied Solar Energy, 3424 N. Central Ave., Phoenix, Ariz.)

5-6. Gas Conditioning Conf., 7th annual, Norman, Okla. (M. L. Powers, Extension Div., Univ. of Oklahoma, Norman.)

6-8. Fundamental Cancer Research, 12th annual, Houston, Tex. (W. K. Sinclair, M. D. Anderson Hospital and Tumor Inst., Univ. of Texas, Houston 25.)

6-8. Optical Soc. of America, annual, New York. (A. C. Hardy, Massachusetts Inst. of Technology, Cambridge 39.)

10-13. American Assoc. of Petroleum Geologists, annual, Los Angeles, Calif. (R. H. Dott, AAPG, Box 979, Tulsa 1, Okla.)

16-21. Nuclear Engineering and Science Cong., Chicago, Ill. (D. I. Cooper, *Nucleonics*, 330 W. 42 St., New York.)

17-21. National Assoc. of Corrosion Engineers, 14th annual, San Francisco, Calif. (NACE, Southern Standard Bldg., Houston 2, Tex.)

18-20. Amino Acids and Peptides, Ciba Foundation symp. (by invitation), London, England. (G. E. W. Wolstenholme, 41 Portland Pl., London, W.1.)

20-22. Pulmonary Circulation Conf., Chicago, Ill. (Wright Adams, Chicago Heart Assoc., 69 W. Washington St., Chicago 2.)

20-23. International Assoc. for Dental Research, annual, Detroit, Mich. (D. Y. Burrill, Univ. of Louisville, School of Dentistry, 129 E. Broadway, Louisville 2, Ky.)

23-26. American Assoc. of Dental Schools, annual, Detroit, Mich. (M. W. McCrea, 42 S. Greene St., Baltimore 1, Md.)

23-29. American Soc. of Photogrammetry, 24th annual, jointly with American Cong. on Surveying and Mapping, 18th annual, Washington, D.C. (C. E. Palmer, ASP, 1515 Massachusetts Ave., NW, Washington 5.)

24-27. Institute of Radio Engineers, natl. conv., New York. (G. W. Bailey, IRE, 1 E. 79 St., New York 21.)

27-29. National Science Teachers Assoc., 6th natl., Denver, Colo. (R. H. Carleton, NSTA, 1201 16 St., NW, Washington 6.)

29. South Carolina Acad. of Science, annual, Charleston. (Miss M. Hess, Dept. of Biology, Winthrop College, Clemson, S.C.)

29-30. American Psychosomatic Soc., 15th annual, Cincinnati, Ohio. (T. Lids, 551 Madison Ave., New York 22.)

30-3. American College Personnel Assoc., annual, St. Louis, Mo. (L. Riggs, DePauw Univ., Greencastle, Ind.)

31-2. Instruments and Regulators Conf., Newark, Del. (W. E. Vannah, *Control Engineering*, 330 W. 42 St., New York 36.)

(See issue of 15 November for comprehensive list)

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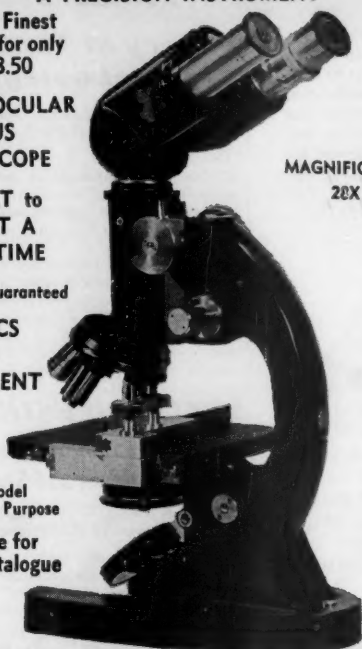
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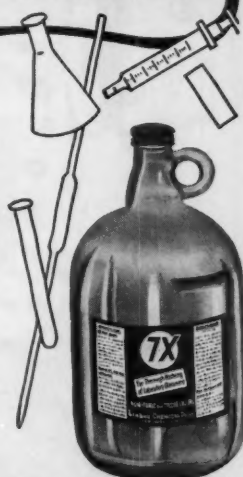


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## LETTERS

The editors take no responsibility for the content of the letters published in this section. Anonymous letters will not be considered. Letters intended for publication should be typewritten double-spaced and submitted in duplicate. A letter writer should indicate clearly whether or not his letter is submitted for publication. For additional information, see *Science* 124, 249 (1956) and 125, 16 (4 Jan. 1957).

### Ehrlich's Slogan

In his obituary of the Japanese bacteriologist Kiyoshi Shiga (1), Oscar Felsenfeld mentions Shiga's association with Paul Ehrlich and writes that he "picked up a slogan, which he attributed to Ehrlich, as the motto of his life: *Geld, Geduld, Geschick, und Glück* (money, patience, fate, and luck). He kept repeating this saying of Ehrlich's and insisted that it governed all his decisions. Shiga, however, was not a money hunter."

I can claim a degree of familiarity with the work and life of Ehrlich, my father, Felix Pinkus, having been one of his pupils (2) and later his friend (3), who at the time of his death in 1947 was engaged in writing Ehrlich's biography. I feel that the sentences quoted contain some errors of interpretation and do not do full justice to either Shiga or Ehrlich.

The slogan is authentic (4, p. 48). My father told me that Ehrlich often said these "four G's" were essential for successful research. However, that the word *Geld* (money) is put first in certainly no indication that Ehrlich was a money hunter. Although his discoveries brought him wealth late in life, only a few of his worst enemies accused him of seeking it (5, p. 216). Whoever knew him well testified that he handled his own affairs rather poorly, that he often spent beyond his means for books and scientific implements, and that he loaned and gave money freely to friends and even to relative strangers who sought his help (4, pp. 50-53; 5, p. 65).

There are three plausible explanations for money being mentioned first by Ehrlich. Foremost, the entire slogan is a paraphrase of the much older one that three G's are needed for waging war: *Geld, Geld, und nochmals Geld* (money, money, and once more money) (6). Second, even modern scientists are painfully aware of the fact that funds are prerequisite to practically all experimental work. Third, a man who, like Ehrlich, had had to work under restricted circumstances for many years and who was not a good businessman is apt to put first what he is least able to provide.

The second word, *Geduld* (patience), needs no explanation. The German word *Geschick*, however, has two quite different meanings (7). It is a synonym either of *Schicksal* (fate) or of *Geschicklich-*

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keit (skill, dexterity, aptitude). It is well documented (4, p. 80) that Ehrlich frequently expressed his ire against the "ungeschickte Taperkerle" (inept totterers) who did not comprehend his theories or could not verify his experimental results. Doubtless, *Geschick* is used here in its second sense of mental aptitude and manual skill.

Interpreted in this fashion, the slogan has valid significance, not so much as a motto for life but as a statement of the requisites of fruitful work, which can well be used to govern a man's decisions. The two central *G's*, *Geduld* and *Geschick*, have to be brought by the researcher himself. To apply them, he needs Geld, and who doubts that, to be really successful, he also needs Glück (good luck, "breaks")?

HERMANN PINKUS

Wayne State University College of Medicine, Detroit, Michigan

#### References

1. *Science* 126, 113 (1957).
2. F. Pinkus, "Lymphatische Leukämie," in P. Ehrlich, *Leukämie, Pseudoleukämie, Hämoglobinaemie* (Hoelder, Vienna, Austria, 1901).
3. —, *Paul Ehrlichs Wirken, Med. Klinik* No. 40/41 (1915).
4. M. Marquardt, *Paul Ehrlich als Mensch und Arbeiter* (Deutsche, Stuttgart, Germany, 1924).
5. H. Loewe, *Paul Ehrlich, Schöpfer der Chemotherapie* (Wissenschaftliche, Stuttgart, Germany, 1950).
6. G. Büchmann in *Geflügelte Worte* [popular edition based on the 26th edition of the *Hauptwerks*, adopted by B. Krieger (Haude & Spensersche, Berlin, Germany, 1919), p. 288] attributes the first Italian version of this saying to Gian-Jacopo Trivulzio (1448-1518), marshal of King Louis XII of France.
7. *Langenscheidts Taschenwörterbuch der englischen und deutschen Sprache*, ed. 7, 1929. Other dictionaries concur.

Oscar Felsenfeld's interesting and dignified obituary on Kiyoshi Shiga [*Science* 126, 113 (1957)] mentions that Shiga adopted Paul Ehrlich's motto of life: *Geld, Geduld, Geschick, und Glück*. Felsenfeld translates the last three words as "fate and luck." I have doubts whether a man of Ehrlich's ability, not only for research but also for verbal expression, would have—in his motto—used two items which are practically synonyms, as fate and luck are. While the German word *Geschick* indeed means "fate," it has another quite different meaning, and it is used in this second sense very frequently in the part of Germany from which Ehrlich originated (Silesia). It is the abbreviated form of *Geschicklichkeit*, meaning manual (and also intellectual) dexterity, handiness, the ability to handle a given task appropriately and smartly.

It is well known that Ehrlich (as well as his pupils, his *Schule*) was very proud and fond of manual dexterity in his histopathological and bacteriological work, especially staining. Ehrlich is reported as having, especially as a young man, dye stains on his fingers. It is this ability for manual tasks which Ehrlich and Shiga

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and their followers valued very highly that—I am quite sure—was expressed by the word *Geschick* in their motto. Shiga, the discoverer of trypan red, was, in Paul Ehrlich's judgment, certainly a *geschickter* collaborator and was probably proud of it.

WILFRED C. HULSE

Mount Sinai Hospital, New York

### Science and the High-School Student

There seems to be some likelihood that the definitive results of Mead and Métraux's study of the "Image of the Scientist among High-School Students" [*Science* 126, 384 (1957)] will be considered as applying only to high-school students and scientists. Since almost all of the appropriate age group attends high school these days, Mead and Métraux's sample is essentially a sample of that age group of the whole population. It is unlikely that this image of the scientist changes much with age. Hence, one concludes that the man in the street has very much the same image. Let us not censure high-school students, even by implication only, for sharing public opinion. The high-schooler who plans to become a scientist has about the same relation to his fellow students as the adult scientist has to his fellow citizens. He may as well get used to it while he is young.

It is likely that the same sort of results would have been obtained regarding physicians, ministers, nurses, or any other dedicated group of people. This not-forme attitude is directed at the dedication, not at the profession. In view of the fact that about 90 percent of the population has an IQ of less than 120, the not-forme attitude is common-sense realism, and the high-schoolers are to be congratulated on their good sense.

I suggest an unscientific generalization of the title to "Image of the Dedicated Minority as Seen by the Undedicated Majority."

M. J. WALKER

Storrs, Connecticut

In his comment on our article, M. J. Walker has combined three themes—the rejection of dedication, the extent to which the high-school student's attitude coincides with that of the man in the street, and the reasonableness of students with an IQ of less than 120 rejecting science as a career. As we pointed out, rejection of dedication in all fields of science is a characteristic of the attitude of post-World War II youth; it would extend to any profession which was seen as requiring an extreme degree of commitment. We know of no material that suggests that rejection of dedication and low IQ are systematically related and



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believe that there would be variations as the career in question was phrased as more or less intellectually demanding. While the attitude of today's high-school students may be said to prefigure the attitudes of the man in the street tomorrow, it is necessary also to recognize that these students have been exposed, rather more than their forebears, to articulate and concerted attempts to involve them in scientific careers, and so they may differ somewhat from their seniors today. The report is not in any sense designed to blame the high-school students but rather to focus attention on the one-sidedness of a picture of the scientific life which overemphasizes the gap between those who do and those who do not participate in it.

MARGARET MEAD  
RHODA METRAUX

New York, New York

### Grants Without Grind

An editorial in *Science* [125, 97 (18 Jan. 1957)] has helped to dispel ignorance among scientists about where and how to seek support for research. It has made me think of ways in which foundations, on their part, could improve their relations with research workers.

Years ago, that task would have been simple. The foundation would have endowed a university or a museum, which then would have hired a staff with tenure for life. That kind of security still works well in respect to basic research in many fields. But there is a greatly increased need today for the support of studies related to specific questions of current interest—a support that does not permit so-called "crash" programs to become "slap-dash" programs.

The amount of time and effort of research workers, and of research administrators, that is required to prepare requests for grants and fellowships has become appalling. At a recent conference of foreign medical educators, one of our European colleagues wondered why so large a proportion of the advance made in his field comes from European, rather than American, scientists, despite the greater funds available here. He hinted that this may be because "we in Europe are free from your kind of red tape." While he and his colleagues pursue their studies, we spend our time preparing requests for funds—often repeatedly, because many of them are rejected. The unsuccessful applicant as a rule does not receive the benefit of the critical appraisal which the foundation's advisers may have spent many hours in preparing. One foundation reports that the average number of references is seven; it costs the time of seven scholars to write seven thoughtful letters. (If, occasionally, such letters are written carelessly, both: the

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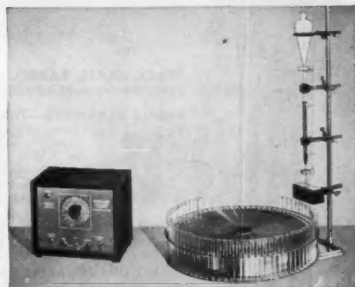
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applicant's and the foundation's time may be wasted.)

Yet another matter deserves attention. In one case our school received a personally written letter asking it to apply for a fellowship, only to learn afterwards that the foundation had thus addressed a hundred times as many people as it had fellowships available. In another instance we applied for funds from one agency, and when the request was rejected, the administrator of another chided us for not having simultaneously applied to his—on another set of forms. In spite of a reputation for liberality in this respect,

one national foundation refused to accept a duplicate of an application we had submitted to a federal agency and demanded 20 copies of an application in a different format.

We need a closer link, it seems to me, between foundations and research workers if the most important phase of research—the planning—is to be adequately supported. At the very least, granting agencies should pay the costs of duplication, circulation, and evaluation of applications and should accept the responsibility of telling unsuccessful applicants in detail why their projects are

rejected. Removing the secrecy which now prevails in this respect admittedly would add to the foundation's job, but to the benefit of science. Moreover, when the foundation executive believes that support for a particular study might more suitably come from another agency, he would render a real service, not alone to the applicant but to scientific progress, by so informing him.

Donors of funds know in a general way what they want of science. So does the public. One of the foundation's functions is to translate such felt purpose into effective scientific research. Scientists share this objective. To achieve this common end, should not the foundation inform the applicant more often than it now does of ways in which he could make his project acceptable? Far from interfering with freedom of research, this form of friendly collaboration would actually advance it by removing one of the frustrations which so often beset the path of the scientist.

GABRIEL W. LASKER

Wayne State University  
College of Medicine

#### Invisible Words—Invisible Evidence

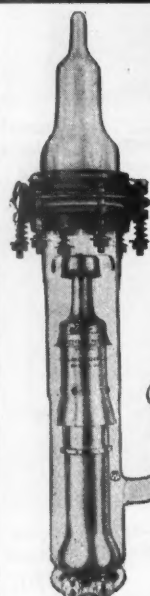
Your recent editorial [*Science* 126, 681 (11 Oct. 1957)] was as usual of timely interest, but it was inaccurate in one respect. The existence of subliminal perception is not as well established as you suggest.

The crux of the problem is the meaning of *limen* or *threshold* in this context. In psychophysical research, *thresholds* are usually defined as the least intensity, size, duration, position, and so on, of a physical stimulus (absolute threshold), or least change in one physical stimulus, or difference between stimuli (difference threshold), which will elicit verbal recognition as determined by the average of a series of measurements. The question is whether it has been demonstrated that physical stimuli below one of these thresholds can influence behavior. I have recently reviewed the considerable experimental work on this question and have arrived at the seemingly obvious conclusion that the demonstrations of the phenomenon are far from conclusive [*Perceptual and Motor Skills* 7, 29 (1957)].

Therefore it is yet to be proved that anyone could have his subconscious polluted by subliminal messages. Being a resident of the Cornhusker State, however, I'm all for it if it can be used to increase the sale of popcorn.

R. C. WILCOTT

Nebraska Psychiatric Institute,  
University of Nebraska College of  
Medicine, Omaha



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Forepressure (maximum) .....	0.02 mm. of mercury
Baffle Temperature .....	35°C. or lower
Heater Voltage .....	100 to 110 volts
Heater Current (at 110 volts) .....	1.7 amperes
Speed, without baffle (approx.) .....	67 liters per second
	at $4 \times 10^{-4}$ to $4 \times 10^{-5}$ mm Hg
Speed, with baffle (approx.) .....	32 liters per second
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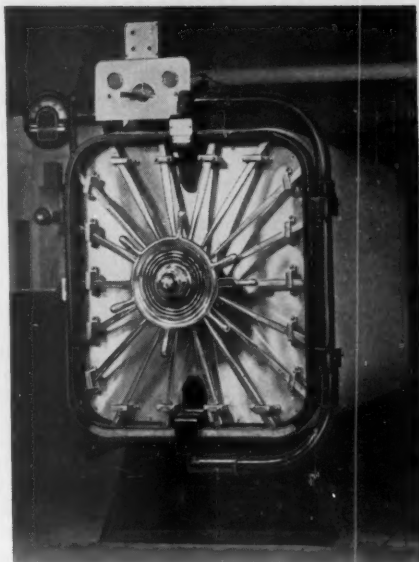
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■ RATE-OF-CHANGE METER operates by sampling a voltage pulse at time  $t$  and storing it for comparison with a second pulse at time  $t + \Delta t$ . The time interval between the two pulses is precisely controlled. The output, which is the rate of change of voltage with time, is displayed directly on the meter scale. Over-all accuracy is 2 percent or better. (Miljan, Inc., Dept. S786)

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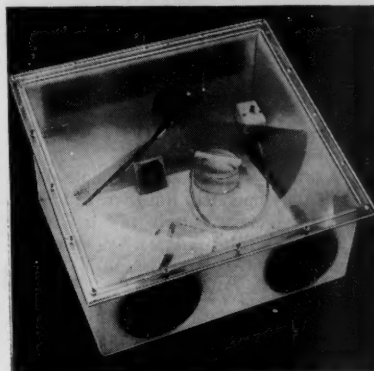
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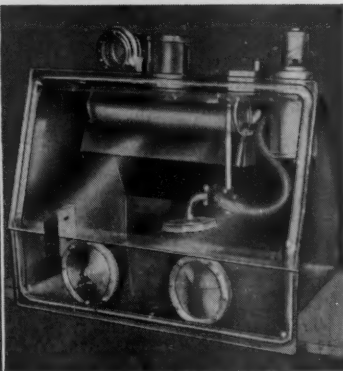
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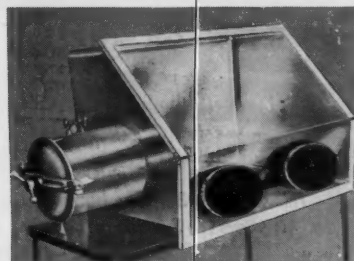
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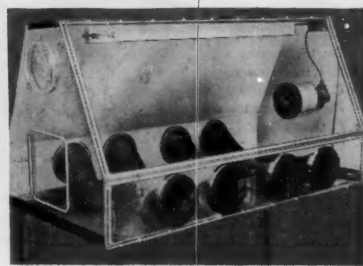


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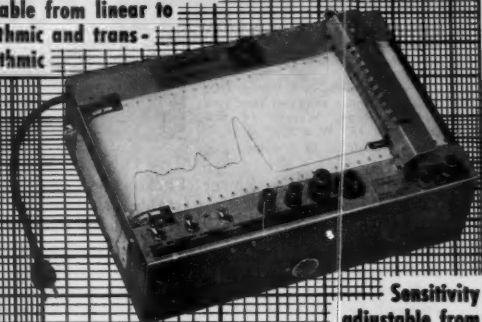
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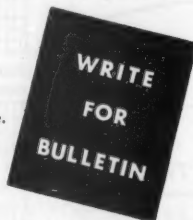
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ment cannot be used with gases containing significant quantities of constituents that would react with silver or with potassium hydroxide in the electrolyte. (Baker and Co., Inc., Dept. S659)

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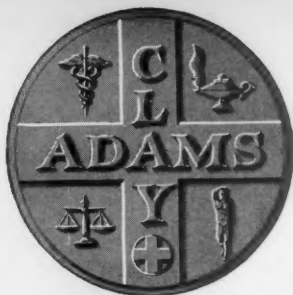
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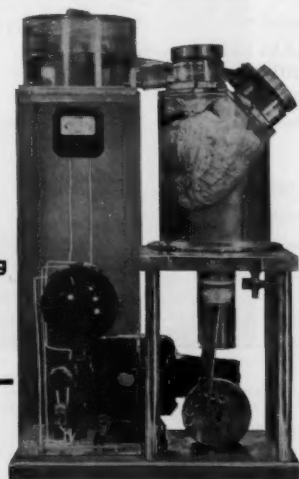
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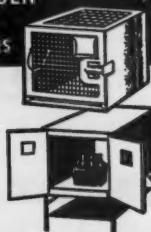
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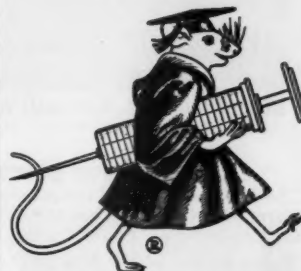
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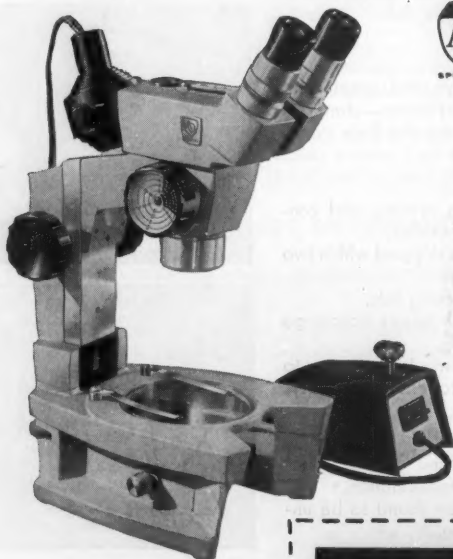
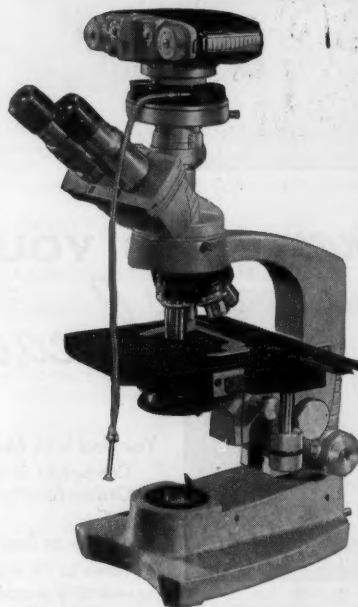
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